STATUS OF THE DOMESTIC URANIUM MINING AND MILLING INDUSTRY: THE EFFECTS OF IMPORTS

HEARING

BEFORE THE

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ENERGY RESEARCH AND DEVELOPMENT
OF THE
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ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
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STATUS OF THE DOMESTIC URANIUM MINING AND MILLING INDUSTRY: THE EFFECTS OF IMPORTS

FRIDAY, SEPTEMBER 25, 1981

U.S. SENATE,
SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:45 a.m., in room 3110, Dirksen Office Building, Hon. Pete V. Domenici presiding.

Present: Senators Domenici, Wallop, and Simpson.

Also present: Paul Gilman, professional staff member.

Senator WALLOP [presiding]. Good morning. Senator Domenici has been delayed in the negotiation on the pending resolution, and has asked that I temporarily Chair for him, and I agreed to that, and would ask that the statement of Senator Domenici in opening the hearing be placed in the record at this point.

[The prepared statement of Senator Domenici follows:]

OPENING STATEMENT OF HON. PETE V. DOMENICI, A U.S. SENATOR FROM THE STATE OF NEW MEXICO

Good morning ladies and gentlemen. This morning we will review the current status and the projected future of the domestic uranium mining and milling industry and the effects of imports on this industry. The Department of Energy will review its report on this matter and the Energy Information Administration will review its analysis of several policy options which could be pursued to mitigate the effect of imports on the domestic industry. The State Department will also present its perspective in this matter as will the American Mining Congress and the Kerr-McGee Corporation and the Rocky Mountain Energy Corporation. We are fortunate to have as our lead witness Governor Ed Herschler from Wyoming representing himself and Governor Bruce King of New Mexico.

Before we hear from Governor Herschler I would like to take a brief moment to express a few thoughts.

The reports provided to this Subcommittee on this matter leave the clear impression that at present the industry is unhealthy. That is not a rude awakening for me because in my State of New Mexico there have been 25 mine closings in the past 2 years and about 3,000 uranium workers have been layed-off. The price of uranium has dropped from $40 per pound to $23.50 since the start of 1980. Both reports presented to the Subcommittee maintain this unhealthy situation is due to the poor overall state of the nuclear power industry. That must certainly be so when the demand for uranium was projected in 1974 to be 35,000 tons in 1980 and the actual demand was 11,400 tons.

We must take steps to revitalize this industry and we are doing so, but I am concerned we will leave the mining and milling industry behind. The analogy between imported oil and imported uranium is often scoffed at because our foreign suppliers are such countries as Australia and Canada. I would urge my colleagues to review the EIA report that concludes that imports may be "the most significant market factor affecting the domestic uranium industry by the end of this decade." Are we to wait till we are dependent on imports before we take action? Are we making the same mistake we did in getting hooked on cheap foreign oil? Will the decline in domestic exploration and production over the next 6 to 8 years assure that once we have revitalized the domestic power industry there will be no revitalization of the mining industry because the market will be held by foreign producers?

There has been much discussion about what a "viable" industry is. While some individual companies may be viable the industry may not be. The analogy to oil is important here. No one will deny that in 1973 the U.S. domestic oil industry was making money, but with 50 percent imports it certainly was not viable in a national security sense.

I would close on this note. Maintaining a viable domestic industry is not just a policy of the United States, it is the law.

STATEMENT OF HON. MALCOLM WALLOP, A U.S. SENATOR FROM THE STATE OF WYOMING

Senator **WALLOP**. Chairman Domenici and members of the subcommittee, I appreciate this opportunity to welcome Governor Herschler, and to express my deep concern, as well, over the dire state of the uranium industry in this country and, most particularly, in my State.

As the Energy Information Administration's working draft on "The Impact of Various Federal Uranium Policies on the Uranium Market" unintentionally understates, "The domestic uranium industry is not in a healthy condition." Of all the understatements that could possibly be put into one Government document, that has to take the cake. The cruel reality of this is sorely reflected in my State by massive layoffs, with towns such as Jeffrey City, located in Wyoming's uranium belt, literally drying up in spite of its residents' pioneering spirit to keep the town alive.

Part of the problem are the two critical time periods spelled out in the EIA's draft working report. For the domestic uranium industry, the first critical period is to survive the rest of this decade. The working draft predicts that, "Because of current oversupply, the industry is expected to diminish significantly over the next 6 to 8 years, a period to be characterized by a sparse market demand and the pressure of excess consumer inventories." This bodes particularly ill for the small mining operators, who will obviously have a hell of a time weathering the decade.

From Wyoming's prospective, I hope that the State's task force studying the plight of the uranium industry in the State can come up with some helpful suggestions to help tide the industry over, and I commend the Governor for setting up this task force under the able leadership of State Senator Roy Peck.

The second critical period follows on the heels of the first, and is marked by the threat of significant foreign competition. This has been a longstanding concern of the domestic uranium industry. It is a longstanding concern of this Senator, not only from the standpoint of industry, but from the standpoint of national security. Although it is a less critical issue at this time, the threat is nonetheless real.

The EIA report projects that, If foreign producer competition and the production of foreign sources are vigorous, and if domestic consumers relax their cautious attitude by reliance on foreign supply, the domestic uranium industry could be reduced to 5,000 tons of production annually—less than a quarter of its present size.

In light of these circumstances, it is clear that the Federal Government must make a concerted effort to get the nuclear industry in the country on its feet, by identifying and eliminating unnecessary costs, delays, and regulatory burdens, and by inconsistency and predictability in those regulations and burdens. In addition, we should investigate our options to steel ourselves against the day that serious foreign competition becomes a reality. The testimony received at this hearing will I hope provide us with some valuable alternatives and recommendations.

I thank the chairman and the subcommittee again for this opportunity to express my views about a subject very close to my heart.

I ask that my colleague from Wyoming, Senator Simpson, who requested to appear before the committee today, be permitted to give his statement in support of the committee's business today.

STATEMENT OF HON. ALAN K. SIMPSON, A U.S. SENATOR FROM THE STATE OF WYOMING

Senator Simpson. Thank you, Mr. Chairman. I want to commend our colleague, Senator Domenici, for his actions, beginning last year, with his amendment to the Energy and Water Development appropriations bill in the Senate on the uranium import restriction question, and for calling these hearings today in order to focus attention on the growing problems facing the uranium industry. I also want to thank him for his courtesy in inviting me to participate in these hearings held by the subcommittee, and I thank you, too, Malcolm, because my efforts as chairman of the Subcommittee on Nuclear Regulations do deal very closely with this particular issue.

Mr. Chairman, subsection 161(v) of the Atomic Energy Act of 1954 establishes, as a matter of national policy, that it is in our national interest to preserve and maintain a viable domestic uranium industry. I don't like the term "viable." I have never figured out what it actually means, but everybody uses it, so it appears one must continue to do that. To me it means strong and healthy and productive in working. In any event, I believe the wisdom of that policy is unquestioned when one considers both the contribution that this industry has made in maintaining our national security and the considerations of energy independence. By almost any standard, Mr. Chairman, this industry is in dire straits. It faces a very uncertain future at best.

Domestic uranium production this year appears to be dropping by about 4,000 tons from the 1980 production level of nearly 22,000 tons of uranium. During this same period, the market price of uranium has plunged from more than $40 per pound at the beginning of 1980 to the present level of about $23 per pound. Long-term supply commitments for uranium, and consequently the financial investments needed to assure future production, have fallen off significantly. Exploration is down, substantially cut back. The near-term demand for uranium remains uncertain and stockpiles of uranium presently exist. Taken together, these factors obviously indicate an industry with considerable difficulties, facing even more severe threats to its future health.

Malcolm, if there is any more clear and dramatic proof, some 2,700 workers in the uranium industry in Wyoming have been laid off in the past 18 months, representing about 36 percent of the work force.

For these reasons, I believe that these hearings on the state of the industry and the relationship of the developing uranium import situation are particularly timely. Prompt attention to the import situation, especially as it relates to the long-term viability of our domestic industry, seems to be an essential addition to the efforts that we already have underway to eliminate unnecessary, excessive, and costly regulatory requirements in this area, and to improve the market situation by eliminating unnecessary delays in the licensing of nuclear powerplants. We will continue those efforts and we have made progress as well.

I am particularly pleased that we have the Governor here to testify. The three of us have served together in the Wyoming Legislature and the delegation enjoys a very fine working relationship with the Governor. I want to commend him for his efforts at the State level to bring attention to the problems. As you stated, the task force is a critically important thing, and he has worked diligently in the State of Wyoming. I am looking forward to his suggestions for assisting this important industry. I look forward to hearing the assessment of the Government and industry witnesses on future projects of the domestic industry and the relationship in consideration of this import policy.

I thank you for the opportunity to participate and express that to the members of the subcommittee.

Senator **Wallop**. Thank you very much for a clear description of the problems that exist and the concern that we all share.

We will invite the first witness to speak now. It is a pleasure for me to welcome you here and to hear what things are going on, not only as Governor of Wyoming, but as chairman of WESTPO.

STATEMENT OF HON. ED HERSCHLER, GOVERNOR, STATE OF WYOMING, CHAIRMAN OF THE WESTERN GOVERNORS' POLICY OFFICE

Governor **Herschler**. Thank you, Mr. Chairman. It is a pleasure to be here this morning. I appreciate the opportunity to visit with this Senate subcommittee on these matters that I think are so vitally important to the economy of the West, particularly the States of Wyoming and New Mexico.

I am here today wearing several hats. One of my hats is that of chairman of the Western Governors' Policy Office, WESTPO. WESTPO is an independent organization of Governors of 13 intermountain and high plains States: Alaska, Arizona, Colorado, Idaho, Montana, Nebraska, Nevada, New Mexico, North Dakota, South Dakota, Utah, Washington, and Wyoming.

As part of its policy management responsibilities, WESTPO serves as a regional forum and provides a mechanism for member Governors to address and influence important national, regional, interstate, and Federal-State issues. The Governors are assisted in this regional policy and program development activity by their executive assistants who together constitute the WESTPO Regional Coordinating Council.

The Governors and the regional coordinating council are assisted by the work of staff advisory committees, composed of key State personnel in energy, natural resources, water, clean air, and functional areas. Work in each functional area is driven by lead Governors appointed by the WESTPO Governor-chairman. Representatives of the private sector are usually consulted in the development of WESTPO policy and program recommendations.

WESTPO, in short, serves member Governors by providing a vehicle for collective political expression and influence, an important asset for the sparsely populated Western States. It also serves as an instrument for policy management; identifying and dealing with issues that crosscut functional areas; promoting accountability by encouraging discussions between the public and private sectors; and promoting the more effective use of existing regional resources and institutions.

Nearly 93 percent of the Nation's total uranium reserves are located within the WESTPO region. Four Western States have been the primary source of uranium for the Nation's nuclear industry—including Colorado, New Mexico, Utah, and Wyoming.

During the 1960's and early 1970's, the uranium industry experienced considerable growth in mining and milling. During those years the Federal Government established appropriate uranium import policies to insure the maintenance of a strong and viable domestic uranium industry. During the past year and a half, however, the demand for yellowcake or uranium oxide has declined substantially. The spot market price has fallen from a peak 1979 price of $43 per pound, to the present level of $23.50 per pound. In constant dollar values, the price has dropped more than 50 percent in only 2 years.

Cutbacks in production have resulted in increased unemploynent throughout the industry. Hardest hit have been New Mexico, Wyoming, and Colorado. In Wyoming, approximately 36 percent of the uranium workers have been laid off during the past year; and in New Mexico, one out of five workers is currently unemployed. In addition, more than 900 jobs have been lost in Colorado's uranium mineral belt.

The critical state of the domestic uranium industry will not change significantly unless appropriate Government actions are taken. Reduced development of U.S. nuclear power capacity, low U.S. ore grades, reduced prices and increased interest by foreign uranium suppliers to capture U.S. uranium demand clearly indicate a nonviable domestic uranium industry. Appropriate Federal Government actions are needed to maintain a domestic uranium industry capable of meeting U.S. energy needs.

It was against this background in May of this year that Governor Bruce King of New Mexico and I cosponsored a resolution which supports the domestic uranium industry. That resolution was finalized and issued on July 15, 1981.

WESTPO Governors recognize that the critical state of the uranium industry has particular implications for Western States and the Nation. Production cutbacks and shutting down of uranium operations not only threaten uranium producers and employees, but the economies of uranium towns and surrounding areas in the intermountain west. Additionally, increased use of foreign uranium as a substitute for domestic uranium supplies will create an unnecessary dependence on foreign energy supplies and significantly affect the viability of the domestic uranium industry.

A number of factors have contributed to the critical state of the uranium industry and WESTPO Governors strongly affirm their opposition to the use of foreign uranium in the United States. The increased use of foreign uranium to meet U.S. energy needs diminishes the viability of the U.S. uranium industry. WESTPO Governors strongly recommend that the Federal Government restrict the use of foreign uranium in the United States so that a viable domestic uranium industry will be maintained, as you so clearly pointed out, Senator Simpson, and as required by the Atomic Energy Act of 1954, section 161(v).

WESTPO Governors understand the restriction of foreign uranium use in the United States can be accomplished by the U.S. Department of Energy establishing new foreign uranium enrichment criteria. WESTPO Governors strongly recommend that new DOE enrichment criteria be immediately established to limit to 20 percent the amount of foreign uranium a domestic utility could enrich on an annual basis for domestic end use. The viability of the domestic uranium industry is in serious jeopardy and immediate DOE action is needed to preclude further deterioration of the U.S. uranium industry.

We have distributed this policy statement to congressional delegations of the WESTPO member States in September. Governor King and I cosigned and forwarded a letter to Secretary Edwards alerting the U.S. Department of Energy to Western States' concerns. In addition, the policy statement has been distributed to many domestic uranium producers.

When Governor King and I were originally notified that congressional hearings were being considered, we both expressed an interest in appearing. Unfortunately, Governor King has a number of duties in New Mexico today that do not permit him to join us. I certainly hope it isn't another prison riot. In lieu of a personal appearance, Governor King has asked me to present a number of points on his behalf.

New Mexico would like to reemphasize the importance of the Federal role and responsibility in maintaining the viability of the domestic uranium industry. The development and history of the U.S. uranium industry is the result of Government policy and sponsorship, and the Federal Government should continue to be cognizant of its continuous responsibilities.

If the administration is dedicated to further developing nuclear energy, as stated in the National Energy Plan (NEP) III, then the Federal Government should not forget its responsibilities to the uranium industry as set forth in the Atomic Energy Act of 1954.

I would also concur with Governor King. The history of the U.S. nuclear industry is the direct result of Federal actions beginning with the Manhattan project. The States have had little if any say in how this industry developed. However, and contrary to pronouncements from the Department of Energy, the domestic uranium industry is not now viable or healthy.

Wyoming and New Mexico are the two largest uranium producing States and in 1980 produced nearly two-thirds of the total U.S. production. However, since the middle of 1979, as I indicated a few moments ago, we have seen the price of yellowcake drop from a high of $43.25 a pound to the current exchange value of $23.50 a pound. As the price dropped so did the output from the mines, and even more importantly the number of people employed at the mines dropped by over 50 percent.

In New Mexico there have been layoffs related to mine closures and production slowdowns resulting in between 2,500 and 3,000 uranium workers becoming unemployed.

In Wyoming 19 mines have reduced operations and several have closed their doors. Nearly 2,900 uranium workers are unemployed and it appears that more will be laid off before the situation is corrected.

If this is indicative of a healthy and viable domestic uranium industry, then I would hate to see the uranium industry when it is unhealthy. Obviously, the Department of Energy doesn't know what it is talking about.

One final point, Governor King and I read the letters and the newspaper articles telling of another layoff and many more uranium miners being put out of work. At the same time, we read newspaper articles describing the $43.6 million purchase by a U.S. utility of Soviet produced yellowcake. Yet next Wednesday, 90 more uranium workers in Carbon County, Wyo. will be laid off, while more imports from the Soviet Union are predicted.

The situation is so bad that just 1 week ago today the Casper Star-Tribune reported that the Jeffrey City, Wyoming Chamber of Commerce had been disbanded. The chamber disbanded because so many of its members are out of business. The loss of much of the uranium industry's payroll forced these businesses to close.

I am neither an expert on the mining or processing of uranium. I am not an expert on foreign trade. I have only attempted to bring you the story of local economic hardships.

The experts tell me that Congress has the power to protect the domestic uranium industry by limiting the amount of foreign uranium used in the United States. I urge you to listen to the pleas from the West, and to take whatever legislative steps are necessary to maintain a healthy domestic uranium industry.

Thank you for this opportunity to present not only my views but the views of other affected western Governors.

Senator **Wallop**. Thank you very much for a well written statement. I will have to agree with you, and there will be an opportunity for us to question the Department of Energy as to what possible benefits the Soviet imports of uranium could be, and certainly if one views the domestic uranium industry as a critical piece of national security, which I think rational persons must, it is pretty hard to see our dependence on the Soviet Union.

Do you have any questions, Senator Simpson?

Senator **Simpson**. Just a couple, Mr. Chairman.

That resolution calls for the immediate establishment of a limit of 20 percent on the amount of foreign uranium that domestic utilities could enrich on an annual basis. Could you just very briefly tell us how you came to that recommendation, that figure? If that is done, do you think that will be helpful for the short-term, or more, for the long-term relief of the industry? What are your observations?

Governor **Herschler**. Senator, as I recall, originally there was a 5-percent limitation. I could be wrong in that. Now I understand it is somewhere around 40 percent, and rumor has it that it is going to be lifted entirely.

Frankly, Governor King and I thought 5 percent wasn't too bad, but we discussed this with a number of companies working in our areas and our States, and they recommended to us that the resolution should contain the 20 percent. I assume that they felt they could live with that. I suspect that there are some witnesses here this morning who could be a little more specific about the 20-percent figure. I am sure that none of them think it should be over 20 percent.

Senator SIMPSON. Are there any other steps that you might want to share with us, although you didn't come out with them on this proposal, that you might have kicked around, apart from this absolute restriction on enrichment, that you might share with us for the record as to especially with more precise address, of the import situation or dealing with any other contributing factors that have led us to this situation?

Governor HERSCHLER. Of course, just off the top of my head, Senator, I suspect that there are a great many impediments to those people who might be contemplating the development of nuclear powerplants by some of the things that have gone on in various areas of our country, and also the various types of regulations of the NRC as to the actual construction of those plants. We know that the supply, of course at the moment, greatly exceeds the demand, but I think that if the companies who were perhaps involved or contemplated creating and building and constructing nuclear power utilities that if they were able to cut some of the maze of the permitting and the regulations, so they would know where they stand from day one until the powerplant was built, they might be more inclined to be going along.

One other thing that does concern is, I suspect that lots of us are talking about the free enterprise system, and that we ought to be able to handle this all by ourselves. Frankly, I think the Government got us into this mess and I think they have an obligation to get us out of it on the processing of yellowcake and through the DOE and the Nuclear Regulatory Commission, and I have not been able to track this down, Senator, but I have been led to believe, and I am trying to locate it, and if I can get any information for this committee I will, it is my understanding that some of the Canadian Provinces subsidize some of their uranium producers so that they can compete more readily in the foreign market.

Senator SIMPSON. Mr. Chairman, I just have one more and then I may submit some other questions in writing and the Governor can respond at his convenience.

I think there is obviously uncertainty regarding the various factors that are to be considered as to whether there is a "viable" industry for purposes of definition under the Atomic Energy Act, and the finding that this is a viable industry. I heard your rather pungent commentary with regard to the Department of Energy and their perceptions in this area. What criteria, other than what we see here, do you recommend to make that determination, and do you believe that the Department of Energy is applying that criteria? Are you satisfied? What is the essence of your discouragement with the way the Department of Energy is making its viability determinations?

Governor HERSCHLER. I frankly don't understand how they have made their determinations, Senator. That is something that eludes my comprehension. I think the Department of Energy has created some of these problems, particularly in the processing and the requirements of how much yellowcake should be processed, how much should be on hand, and I think they got themselves into a bind, and now they are changing the ball game, and they find that a lot of utilities, of course, that have had long-term contracts with the producers, are selling some of their yellowcake, of which they have got an oversupply because of contracts, in the spot market. Now, the change in philosophy by the DOE has really, you might say, killed the uranium industry, the producers. I think that is something that would be worthwhile looking into, sir.

Senator SIMPSON. Well, that is one of the things we will be pursuing here today.

Senator WALLOP. I think that decision was not, indeed, made by the Department of Energy either under Carter or President Reagan. It is my understanding from the staff that that was a decision made some years ago by the old Atomic Energy Commission to begin phasing it out. The figure is now 40 percent, and I think in 1984, 10 years from the time that decision was implemented, it is supposed to be zero. As often happens, things made 10 years fall through the cracks of consciousness until all of a sudden the pinch begins to hurt so that people wake up and review them. I think it is time that that whole policy matter was reviewed.

Governor HERSCHLER. It seems to me a number of producers and milling operators, of course, came into this under one sort of rules, I think, concern for our national security, concern for the use of our uranium, and production of utilities, military hardware and so on, and then all of a sudden they find themselves making great investments, and then the rules change. And I think it is a very serious situation for our uranium industry.

Senator WALLOP. I couldn't agree with you more, that is one of the reasons the industry is so sick now is that the major utilities are simply not committing to construction. Many of them are finding a billion dollars spent to be cheaper than going ahead and completing it, and that is part of the problem as well. And most of that is as a result, as you point out, and I point out in my statement, of inconsistency and unpredictability in Government regulations that they begin applying about halfway through their application—redesign and many of those things take place, they are under construction, even in the application phase, because—Senator Simpson has been working on that—they have dropped it to——

Senator SIMPSON. We have it pared down to the sixties, depending on whose version you are using. Going through various things, hopefully, on the authorization bill with interim low power licensing and chopping through those delays, because it is unheard of that we have ever had delays that like between the issuance of completion of construction and the issuing of the operating license. Absolutely absurd. And that is what we are trying to hack around.

Senator WALLOP. It is a matter that the country has to have the political confidence and courage to take care of, the cycles of public emotion involving nuclear energy. It simply hasn't been able to withstand the momentary laser beams when public confidence gets shaken.

If the Government has no confidence it is hard for the public to maintain it, and it is hard to get investors to have much confidence in the pattern that has developed over the past.

Senator **Simpson**. May I ask one further question?

If these measures like the enrichment restriction you have recommended are not adopted, what do you foresee as the future of the industry both short-term and long-term, and particularly the impact on the four Western States that produce this tremendous percentage of America's uranium?

Governor **Herschler**. It is going to have a great impact upon our State. Fortunately for some of those uranium people who have been laid off, they have been able to be absorbed in the coal field, if you will, and some of the drilling activities for oil and gas that we have in the Overthrust Belt in the Southwestern States, but that doesn't help all those who are unemployed, the businesses that relied upon them.

One other problem that we have is that many of these companies are cutting back operations, or they are closing their mines. One of the problems we have is that through our Department of Environmental Quality they are required to reclaim all of that before they disband them, if you will. We are trying to make some adjustments for that so that, hopefully, this depression, if you will, with the uranium industry will turn around, perhaps. So we are going to try to relax some of those environmental quality requirements so that they will not have to reclaim and then come back 5 years from now and reopen again. We are going to try to do that for them.

Frankly, I don't have the answer as to what we can do. We have got the committee that Senator Wallop referred to working on that. We are meeting with them next week. We are getting key people together to try to give them some relief in that area. On our state leases, we will probably extend them without forfeiture because of lack of due diligence, if you will, in mining. We are trying to do what we can to help those who are unemployed, trying to find them additional jobs, but, for example, as the Senator pointed out, Jeffrey City is still almost a ghost town now. They have had a couple or 3,000 people leave a year and a half ago.

Senator **Simpson**. I know you will furnish us the results of that task force, especially that part about you can relieve the position they are in when they are saying that because of the economic downturn they considered the mine as being abandoned and, therefore, have to go through this restoration issue, which is indeed absurd. I hope we will handle that very nicely down there.

Governor **Herschler**. We also find that we have some difficulties in coordinating our efforts with our land reclamation, our water and air, and so on, with the NRC. At times they are cooperative and at other times—depending on what the job is. If it is a real dirty job, they are very cooperative, but something they can show their authority very easily, they are not very cooperative.

Senator **Wallop**. I ask you to wear your WESTPO hat as well as your Governor's hat. In your statement you said that the States would like some say in the setting of policy in the nuclear industry.

Has WESTPO, or have you given any thought as to what form that would take, or is that a recommendation that you could forward to the committee?

Governor **Herschler**. Senator, I think what I meant in my statement, and I hope I didn't confuse you, was that the original structuring of the uranium industry, if you will, in the whole United States was established by the AEC and by the Federal role that was played. We did not have any say in that, and now we are being confronted with economic losses, unemployment, and things of this kind, something that we don't think we brought about, and we think that the Feds have some responsibility for turning that around.

Senator **Wallop**. I understand, but is there means that you feel comfortable with that either has been or could be established whereby the States would have a greater say in the development of these policies?

Governor **Herschler**. I am not saying that we should be involved in that, Senator. The only thing is that I would hope that they will establish a policy and try to make a viable, if that is the proper word, and I agree with Senator Simpson, I don't particularly care for that word, a viable uranium industry, I have no quarrel with the Federal Government doing that, but I also think that if they start out under one set of rules they ought to stay with the same set of rules rather than getting somebody hooked and changing the rules of the game.

Senator **Wallop**. Thank you very much for your testimony.

The next witnesses come in a panel, to Hon. Shelby T. Brewer, Assistant Secretary for Nuclear Energy, Department of Energy, the Honorable J. Erich Evered, Administrator, Energy Information Administration, the Department of Energy, the Honorable Harry R. Marshall, Jr., Deputy Assistant Secretary for Oceans and International Environmental and Scientific Affairs, Department of State.

Please proceed, Mr. Brewer.

STATEMENT OF SHELBY T. BREWER, ASSISTANT SECRETARY FOR NUCLEAR ENERGY, DEPARTMENT OF ENERGY, ACCOMPANIED BY WILLIAM VOIGT, ACTING DIRECTOR, OFFICE OF URANIUM ENRICHMENT AND ASSESSMENT

Mr. **Brewer**. Thank you, Senator. We are pleased to be here. I am accompanied today by Mr. William Voigt, Acting Director, Office of Uranium Enrichment and Assessment.

The Atomic Energy Act of 1954, as amended, provides that the Department of Energy shall restrict enrichment services for uranium of foreign origin intended for use in the U.S. power system. After congressional hearings in 1974, a plan was announced that permitted initial use in 1977 of up to 10-percent foreign uranium for a domestic enrichment service. The allowable percentages increased to 15 percent in 1978, 20 percent in 1979, 30 percent in 1980, and 40 percent in 1981. The plan increases the amount to 60 percent in 1982, 80 percent in 1983, and beginning in 1984 there will be no established limit.

The Department of Energy is also required to monitor foreign uranium imports for domestic use and its effect on the domestic uranium producing capability. If the domestic use of foreign uranium should impair the common defense and security, the Department is required to institute corrective measures as deemed necessary.

The health of the domestic uranium producing industry and how the imports of uranium by U.S. buyers may be affecting the industry were studied in our report entitled, "The Domestic Uranium Industry and Imports of Uranium," dated February 23, 1981. This report was prepared at the request of Senator Domenici. Although there have been cutbacks in exploration and production and thus in employment, foreign uranium, we feel, has not been the central cause of this problem. The actions have been the consequence of falling prices and lack of uranium buying activity, a reflection of the domestic near-term oversupply situation. This situation is caused principally by reactor delays and cancellations, and the lack of new reactor orders, rather than the loss of market to foreign uranium.

As you know, Mr. Chairman, the President and the Secretary of Energy are strongly committed to restoring the health of the nuclear option in the United States which has been so badly eroded in the past decade by regulatory and policy instability, as well as other factors.

During 1980, the U.S. uranium industry produced a record high of 21,850 short tons of U_3O_8, which kept the United States well in the lead as the world's largest uranium producer. Given the modest requirements projected over the next few years, the uranium producing industry has too much capacity. This has resulted in a classic oversupply situation.

Essential to the production of uranium is a vigorous and successful exploration effort. The United States has had a large exploration activity in recent years which involved over 100 companies. The recent history and plans for exploration are summarized in chart 2 of the formal testimony.

Exploration effort is a good measure of the producer industry projections of the future of the industry. Plans for 1981 and 1982 would seem to indicate that uranium is an unfavorable exploration investment.

Turning now to uranium industry employment, chart 3 of the statement presents the recent history of employment in mining, milling, and exploration. In the early seventies, the total annual industry employment averaged about 6,000 people. And this increased to a peak of 22,000 people in 1979, and then decreased to an average of about 19,000 or 20,000 people in 1980. Even though this is a disturbing trend, the total employment in the industry is about the same as in 1977, which followed a rapid industry expansion.

As noted earlier, Senator, expenditures for exploration have been decreasing. Chart 4 of the statement shows the recent history and trends in capital expenditures in milling facilities, mine plant and equipment, and exploration equipment. Although these reductions are substantial, planned expenditures in 1982 are above the expenditures for 1975, in a period when the industry was expanding.

Let's turn to the data for the actual use of foreign uranium. The actual use of foreign uranium in the United States has been low, as seen in chart 5 of the prepared statement. Through August 1981, the actual deliveries of foreign origin uranium for enrichment have been about 5 percent of total deliveries, well below the allowable 40 percent.

Although there will be continued use of foreign uranium in the United States, we expect U.S. buyer preference for domestic uranium to continue.

For the next 5 or 6 years the unfilled uranium requirements are very limited since substantial delivery commitments are under contract. Contracts are mainly with domestic uranium producers. Contract requirements are projected to be filled largely by U.S. produced uranium.

Even though foreign deliveries to DOE enrichment plants have been well below allowable limits, foreign uranium is viewed with concern by domestic uranium producers. The foreign producers' position is strong, but it exists in only a few countries.

The United States is largely self-sufficient, and it has the capability of remaining so through at least the nineties. However, the status of the domestic uranium producing industry, U.S. buyer activity, and the development and marketing of foreign uranium will need continuous monitoring in the future.

The United States has been a net exporter of uranium for commercial uses. Through the end of 1980, the United States exported 19,400 short tons of U_3O_8 compared with imports of 11,200 short tons of U_3O_8. For the 1981 to 1990 time period, imports under contracts are scheduled to total 15,800 short tons, while scheduled exports under contract should amount to 8,500 short tons.

DOE inventories of natural and enriched uranium amounted to the equivalent of 81,400 short tons as of June 30, 1981. Based on present long range planning, the DOE inventories will be able to meet U.S. Government programs through at least the mid nineties.

There is absolutely no plan to sell or otherwise dispose of DOE-owned inventories on the U.S. commercial market. It is DOE's policy not to provide uraniun to commercial users except in emergency conditions.

A change in the schedule for the removal of restrictions on the use of foreign uranium would be of little help to the uranium producing industry since domestic use of foreign uranium has been low. In the 4½ years since the restrictions have been lifted, less than 10 percent of foreign uranium has been brought to DOE for enrichment.

We feel that the imports of uranium are not the problem, certainly not in the near term, facing the domestic uranium industry. The problem, quite clearly, is the cancellation of plant orders, light water reactor plant orders in the pipeline and the failure of a new renaissance of orders in the 1970's for new capacity.

The key to recovery of the uranium industry is revitalization of the nuclear option.

Thank you, Mr. Chairman. Mr. Voigt and I will be pleased to answer any questions you might have at this time.

[The prepared statement of Mr. Brewer follows:]

STATEMENT OF
SHELBY T. BREWER
ASSISTANT SECRETARY FOR NUCLEAR ENERGY
U.S. DEPARTMENT OF ENERGY
BEFORE THE COMMITTEE ON ENERGY AND NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT
UNITED STATES SENATE
SEPTEMBER 25, 1981

Mr. Chairman, we are pleased to appear before you today to discuss the health of the domestic uranium producing industry and especially how the imports of uranium by U.S. buyers may be affecting the industry.

BACKGROUND

Section 161v of the Atomic Energy Act of 1954, as amended, provides that DOE, "to the extent necessary to assure the maintenance of a viable domestic industry," shall not offer enrichment services for uranium of foreign origin intended for use in a U.S. power reactor. After Congressional hearings in 1974, a plan was announced (see Chart 1) that permitted initial use in 1977 of up to 10 percent foreign uranium for a domestic enrichment services customer's feed to DOE. The allowable percentages increased to 15 percent in 1978, 20 percent in 1979, 30 percent in 1980, and 40 percent in 1981. The plan increases the amount to 60 pecent in 1982, 80 percent in 1983, and beginning in 1984 there will be no established limit.

The announcement also stated that DOE "will monitor the extent of importation of foreign uranium for domestic use and its effect on the viability of the domestic uranium producing industry." Further, "if the extent of domestic use of foreign uranium should impair or threaten to impair the common defense and security," the DOE "will institute such measures as are deemed necessary."

DOE STUDY

The health of the domestic uranium producing industry and how the imports of uranium by U.S. buyers may be affecting the industry were discussed in our report "The Domestic Uranium Industry and Imports of Uranium," dated February 23, 1981. A copy of the report is being provided for the record.

We believe the conclusions in our February report are still valid today. That is, the plan for removal of restrictions on the use of foreign uranium has worked well. There does not appear to be any current need for changes to the plan. Indeed, the use of foreign uranium has been quite low as U.S. buyers have preferred to buy U.S. uranium. Although there are cutbacks in exploration and production and, thus, in employment, foreign uranium has not been the cause of these problems. The actions have been the consequence of falling prices and lack of uranium buying activity, a reflection of the domestic near-term oversupply situation. This situation is caused principally by reactor delays and cancellations, and the lack of new reactor orders, rather than the loss of market to foreign uranium. A revitalization of the nuclear power industry will help to assure a healthy uranium industry.

STATE OF THE U.S. URANIUM PRODUCING INDUSTRY

During 1980, the U.S. uranium industry produced a record high 21,850 short tons U_3O_8, which kept the U.S. well in the lead as the world's largest uranium producer. Based on existing sales contracts, production over the next 4 or 5 years is projected to remain at high levels, which should maintain reasonable revenues. As a consequence of high sales levels in 1980 and increasing average sales prices, some U.S. uranium producing companies reported record earnings last year.

Given the modest requirements over the next few years, the uranium producing industry has installed too much capacity. The producing industry has proven to be more robust than its customers. This has resulted in a classic oversupply situation. Adjustments of supply to levels more in balance with demand will be necessary for the industry. Thus, some capacity must be shut down and/or some facilities must be operated at levels below full capacity to remedy this oversupply situation. However, from the nation's point of view, oversupply problems are the best kind of "problems" to have for such an important energy commodity.

Essential to the production of uranium is a vigorous and successful exploration effort. The U.S. has had a large exploration activity in recent years which involved over one hundred companies. The recent history and plans for exploration are summarized in Chart 2. Exploration expenditures and effort increased rapidly during the 1970's, reaching a peak in 1978. Although expenditures remained essentially constant in 1979 as compared to 1978, drilling footage decreased in 1979. This decrease occurred before the drop in uranium prices, and probably reflected the uranium producing industry's realization that cutbacks were necessary in order for production to be more in line with requirements. In 1980 industry planned to drill 39 million feet, but actually drilled only 28 million feet. Planned drilling for 1981 was 20 million feet, but actual drilling will be below that amount.

Exploration effort is a good measure of the producer industry reading of future prospects for the industry. Exploration projects are quickly started-up or turned-off, or directed to other commodities depending on the prospects to provide a good return on investment. Plans for 1981 and 1982 would seem to indicate that uranium is an unfavorable exploration investment. We will continue to study this subject.

Turning now to uranium industry employment, Chart 3 presents the recent history of employment in mining, milling, and exploration. In the early 1970's, the total annual industry employment averaged about 6,000 people. This increased to a peak of 22,200 in 1979, and then decreased to an average of 19,900 in 1980. The actual total loss of employment by the end of 1980 probably was close to 4,000 people. The downward trend has continued in 1981 as some 2,700 additional people have been laid-off in the first seven months of the year. Even though this is a disturbing trend, the total employment in the industry is about the same as in 1977, which followed a rapid industry expansion.

As noted earlier, expenditures for exploration have been decreasing. Chart 4 shows the recent history and trends in capital expenditures in milling facilities, mine plant and equipment, and exploration equipment. Total expenditures reached a peak in 1979 of $800 million. This decreased to $780 million in 1980, although higher expenditures were planned for the year. A very sharp reduction in plans for 1981, from $830 and $450 million, has been reported. A further reduction to $350 million is planned for 1982. Although these reductions are substantial, planned expenditures in 1982 are above the expenditures for 1975, a period when the industry was expanding.

ACTUAL USE OF FOREIGN URANIUM

The actual use of foreign uranium in the U.S. has been low, as seen in Chart 5. For example, in 1980 when 30 percent of the uranium delivered to DOE for enrichment could have been of foreign origin, only 10 percent was actually of foreign origin. Through August of 1981, the actual deliveries of foreign origin uranium for enrichment have been 5 percent of total deliveries, well below the allowable 40 percent. This percentage could change when the data for the whole year are available; however, it would appear that domestic utilities continue to prefer the use of U.S. uranium and the security offered by domestic uranium producers. Although there will be continued use of foreign uranium in the U.S., we expect U.S. buyer preference for domestic uranium to continue.

For the next five or six years the unfilled uranium requirements are very limited, since substantial delivery commitments are under contract--contracts mainly with domestic uranium producers. Contract requirements are projected to be filled largely by U.S.-produced uranium. We believe there will be limited potential for additional delivery of foreign uranium for the next several years because of the small unfilled requirements during that period. For example, in 1980 only one new contract was signed by domestic buyers for the annual deliveries of 250 short tons U_3O_8 of foreign uranium over the 1982 to 1990 time period.

FOREIGN URANIUM SUPPLY

Even though foreign deliveries to DOE enrichment plants have been well below allowable limits, foreign uranium is viewed with concern by domestic uranium producers. The foreign resource position is strong, but contained in only a few countries. In particular, Canada and Australia are potential sources of additional low cost uranium that could seek a market in the United States. In the near term, the production operations in foreign countries that are firmly commited for construction have sold much of their production to foreign buyers. However, there is a potential for longer range foreign penetration in the U.S. market from additional facilities that may be built. Thus a possible longer term problem may exist, largely depending on U.S. buyer policies. The U.S. is largely self-sufficient and has the capability of remaining so through at least the 1990's. However, the status of the domestic uranium producing industry, U.S. buyer activity, and the development and marketing of foreign uranium will need continuous monitoring in the future.

EXPORTS OF DOMESTICALLY PRODUCED URANIUM

The U.S. has been a net exporter of uranium for commercial uses. Through the end of 1980, the U.S. exported 19,400 short tons U_3O_8 compared with imports of 11,200 short tons U_3O_8. In 1980, exports amounted to 2,900 short tons U_3O_8 while imports totalled 1,800 short tons U_3O_8. For the 1981 to 1990 time period, imports under contracts are scheduled to total 15,800 short tons U_3O_8, while scheduled exports under contracts should amount to 8,500 short tons U_3O_8. However, past projections have indicated that the amount actually imported decreases as compared to the schedules, whereas the amount actually exported increases as compared to the scheduled deliveries.

DOE URANIUM INVENTORIES

Some people in the uranium producing industry have expressed some confusion as to the Government's plans and policies regarding the use of DOE inventories of uranium. As way of background, DOE inventories of natural and enriched uranium amounted to the equivalent of 81,400 short tons U_3O_8 as of June 30, 1981. These inventories are stored at DOE's enrichment plants. Of this amount, the equivalent of 48,000 short tons U_3O_8 will be needed at the DOE enrichment plants for working and strategic inventories when the plants are fully operational. The remaining DOE natural and enriched uranium inventories will be used to meet the long-term requirements of U.S. Government programs--primarily the Naval Reactors program--and U.S. Government commitments. Based on present long-range planning, the DOE inventories will be able to meet U.S. Government programs through at least the mid-1990's.

There is absolutely no plan to sell or otherwise dispose of the DOE-owned inventories on the U.S. commercial market. It is DOE's policy not to provide uranium to commercial users, except in emergency situations where a customer can demonstrate that time would not allow procurement of uranium through normal procedures, and he has attempted to satisfy his uranium needs from commercial sources. The preferred method for covering such emergencies is through lease of the uranium, in which case the customer would eventually procure the uranium from the commercial market and return the amount leased to DOE. In such an arrangement, the customer must indicate a delivery date for the uranium which would permit the return to DOE in a time frame consistent with DOE enrichment plant operating plans. No uranium has been provided for several years under the emergency program.

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CONCLUSION

A change in the schedule for removal of restrictions on the use of foreign uranium would be of little help to the uranium producing industry since domestic use of foreign uranium has been low--in the 4 1/2 years since the restrictions have begun to be lifted, less than 10 percent foreign uranium has been brought to DOE for enrichment. Evidence to date is that U.S. buyers are, in effect, conservatively limiting the amount of foreign uranium that will be used. The domestic utilities are aware of the possible risks of reliance on foreign supplies.

A change in the schedule for removal of restrictions on the use of foreign uranium would create confusion and uncertainties for uranium producers and buyers alike. The resulting disruption would delay the return of conditions that would allow the growth of the uranium demand needed by the uranium producing industry.

CHART 1

ALLOWABLE LIMITS FOR THE ENRICHMENT OF FOREIGN URANIUM

Year	Allowable Percent
1977	10
1978	15
1979	20
1980	30
1981	40
1982	60
1983	80
1984 and beyond	100

Announced in the Federal Register on October 25, 1974 (39 FR 38016)

CHART 2

U.S. EXPLORATION ACTIVITY & PLANS

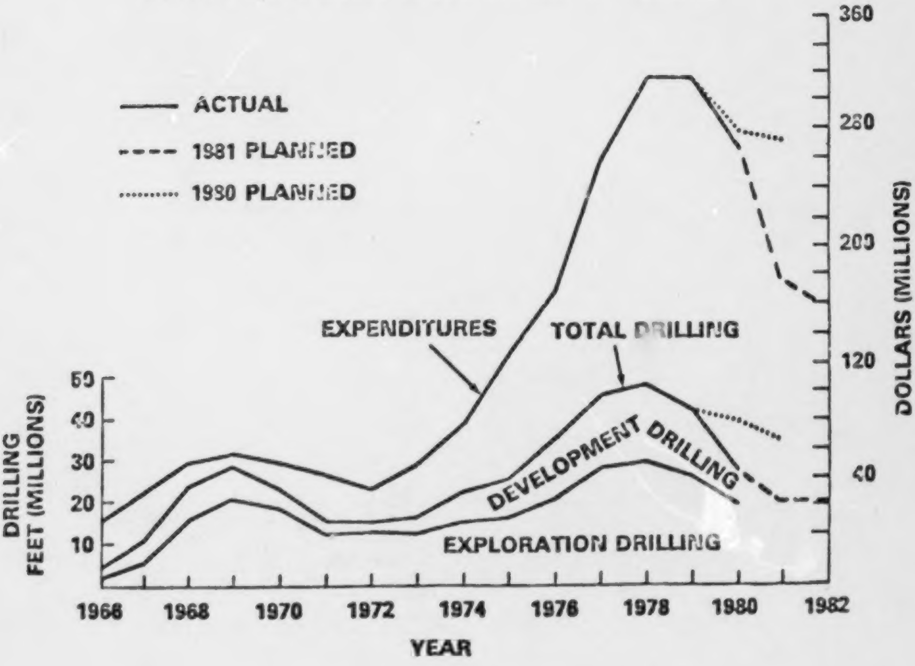

CHART 3

U.S. URANIUM INDUSTRY EMPLOYMENT

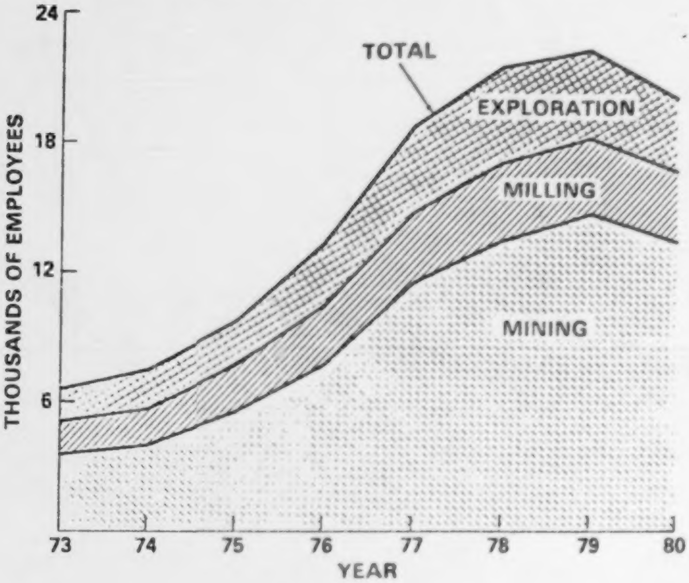

CHART 4

U.S. URANIUM INDUSTRY CAPITAL EXPENDITURES

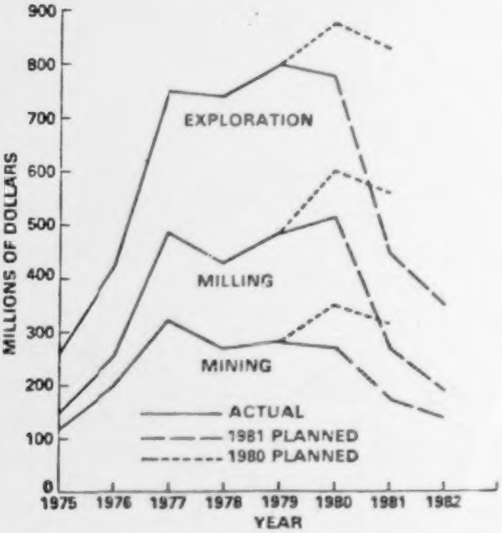

CHART 5

DELIVERIES OF URANIUM TO DOE FOR ENRICHMENT BY DOMESTIC URANIUM ENRICHMENT CUSTOMERS

Year	Origin (Tons U_3O_8)			Percent Foreign	
	U.S.	Foreign	Total	Actual	Allowable
1977	14,240	703	14,943	4.7	10
1978	11,957	728	12,685	5.7	15
1979	15,436	1,591	17,027	9.3	20
1980	11,135	1,241	12,376	10.0	30

Senator DOMENICI [presiding]. Thank you very much, Mr. Secretary.

Let me first apologize to the distinguished Governor of Wyoming for my failure to be here when he testified, and to you, and I thank my good friend, Senator Wallop, for filling in for me. I was on the floor trying to work out this continuing resolution so that we can resolve the issue and so that I am not here all day debating that.

I welcome you, Senator Simpson. You are not on the committee, but we know of your genuine interest in this concern.

Senator SIMPSON. It is very kind of you to allow me to attend.

Senator DOMENICI. We have heard from the Governor. Is Secretary Brewer the first witness on this panel, Senator Wallop?

Senator WALLOP. Yes.

Senator DOMENICI. Would it be satisfactory with you if we then proceed to the other two witnesses before we ask questions?

Senator WALLOP. Fine.

Senator DOMENICI. Can we then proceed to hear the Administrator of the Energy and Information Administration, Department of Energy, J. Erich Evered.

STATEMENT OF J. ERICH EVERED, ADMINISTRATOR, ENERGY INFORMATION ADMINISTRATION, DEPARTMENT OF ENERGY, ACCOMPANIED BY DR. R. GENE CLARK, DIRECTOR, NUCLEAR AND ALTERNATIVE FUELS DIVISION

Mr. EVERED. Mr. Chairman, and members of the subcommittee, my name is J. Erich Evered and I am Administrator of the Department of Energy's Energy Information Administration. I am accompanied today by Dr. R. Gene Clark, Director of EIA, Nuclear and Alternative Fuel Division. I appreciate the opportunity you provide today to discuss the future outlook for the domestic uranium industry and to review an EIA analysis of various uranium policy options.

The EIA is the Federal Government's source for independent energy data collection and analysis. Because of its legislative mandate, EIA must insulate itself from policy-oriented activities. On request, as is the case with this analysis, we do project the impacts of various policy alternatives on energy markets, taking into account the particular policy options specified by our client, the requesting party.

The EIA analysis, entitled "The Impact of Various Federal Policies on the Uranium Market," was prepared at the request of the chairman of this subcommittee, and a copy has been provided for the record.[1] We were asked to analyze the effect that a variety of policy options would have on the market outlook for both domestic and foreign uranium in the United States. The policy options we reviewed included:

One, the current policy under which the Department of Energy's domestic enrichment customers have an upper limit in 1981 or 40 percent on the fraction of their uranium that can be of foreign origin. In 1982 the limit will be 60 percent, followed by 80 percent in 1982 and no limit thereafter, as outlined by Mr. Brewer;

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[1] See the appendix.

Two, deferred phaseout of import restrictions which would maintain an import limit of 30 percent for 5 years, then return to the phaseout schedule for removal of restrictions;

Three, an import ceiling which would limit use of foreign uranium to 20, 30, or 40 percent of domestic requirements from 1982 forward;

Four, import tariffs to offset potential cost differences between domestic and foreign uranium production;

Five, changes to enrichment services transactions increasing the demand for uranium by increasing the so-called transaction tails assay at the Department's uranium enrichment complex;

Six, an international commodity agreement wherein an international buffer stockpile of uranium would be established, to be increased in times of low prices and sold in times of high prices, providing a stable market for producers; and

Seven, enlargement of the Federal stockpile with more domestically produced uranium to support the industry.

It is important to keep in mind that estimates of future impacts are projections and not facts. Neither EIA nor anyone else can foretell the future with certainty. These projections are designed to be internally consistent and to assist analysts and policymakers in evaluating alternative energy policies under a range of future economic and technical assumptions.

The analysis presented here does not cover any international law or foreign policy considerations. Thus, it must be considered as less than fully comprehensive. Furthermore, the analysis system relies, of necessity, on simplified representations of market behavior that may not capture future behavioral characteristics accurately. Therefore, the estimates of policy impacts are just that—estimates based on an assumed set of relationships.

The domestic uranium supply industry is currently experiencing a phasedown, an action necessitated by unrealized expectations for demand—expectations reinforced by a surge in the market price of uranium in 1974 and 1975. The lack of development of expected demand has resulted in domestic production capacity well in excess of current demand and in large and growing inventories of uranium. Furthermore, this oversupply situation is international in scope.

A point to note in our analysis is that the current downward momentum in activity of the domestic uranium industry would not likely be halted in the near term of 6 to 8 years by any of the policy options analyzed, although the trend might be tempered somewhat by either option 5, enrichment services transactions, or option 7, Federal stockpiling.

Although not a major factor in the near term, competition from imports is a potential factor in the longer term of 9 years and beyond. We find that either option 3, import ceiling, or option 4, import tariff, could be effective in insulating the U.S. market if it appeared that an unacceptable level of imports were likely.

In estimating the impacts of these policies, we have relied on a variety of information sources and analysis tools. In many instances, we were able to draw conclusions from basic consideration of DOE data, as collected from the various uranium market participants. In other instances, or to test our professional judgments more fully, we have relied on more sophisticated analysis systems.

For the most detailed projections, we used a model that simulates the actions of participants in the uranium market. Uranium supply contracting actions and uranium production and investment actions are all considered in this analysis system. The dynamic representation of domestic market participation is especially detailed. International uranium supply and demand considerations are captured by satellite models of lesser detail.

The most current official DOE data on domestic uranium resources, uranium contracts in place, and current inventory levels were incorporated into the analysis. Estimates of future deliveries of uranium to the DOE enrichment plants form the basis for consumption in this simulation system. Estimates of future deliveries, provided by the DOE enrichment office, were found to be consistent with official EIA nuclear power projections and were incorporated.

In addition, estimates of uranium production and capital cost elements were obtained and confirmed by inspection of industry records. Finally, our analysis methodology and preliminary results were reviewed by various Government agencies and industry groups, representing both consumers and producers of uranium. Substantive comments were considered in the development of the final analysis.

Because of the recent oversupply situation, the market price for uranium under new contracts, as published by the Nuclear Exchange Corp., fell precipitously from over $40 per pound at the start of 1980 to a current level of about $23.50 per pound of U_3O_8—a level below the estimated operating costs of about 80 percent of domestic production capacity. However, by virtue of prices imbedded in contracts already in place, the average price for deliveries made in 1981 will likely exceed $30 per pound, with some contract prices exceeding $55 per pound.

The year 1981 to date has been characterized by reduced employment and investment levels and other cutbacks in uranium operations. The near-term outlook for the industry is judged to be one of continued reduction in the industry's size. The Grand Junction Office of DOE informally estimates that domestic uranium production in 1981 will be 17,500 to 18,000 tons, down from an alltime high of 21,800 tons of uranium production in 1980. Consumers' requirements for delivery to the DOE enrichment complex will likely be about 14,000 tons in 1981.

With respect to the future, our analysis points to two critical time frames for the domestic uranium industry, as Senator Wallop earlier indicated. Because of market forces generated by current oversupply, domestic uranium production, and investment levels might very well diminish significantly over the next 6 to 8 years, a period to be characterized by sparse market demand and the pressure of excess buyer inventories. In this period, imports are not expected to be a major source of supply to the United States. On the other hand, competition from imports is potentially the most critical market factor facing the domestic industry to the end of the 1980's.

If foreign producer competition and the development of foreign resources are vigorous, the domestic industry could be reduced to less than 5,000 tons of annual production during the first 4 years of the 1990's—less than a quarter of its present size. At such a size, the domestic uranium industry would supply about 20 percent of the domestic demand. The tradeoff to the Nation would be that consumers could enjoy lower uranium costs, and, therefore, lower electricity costs, than would otherwise be the case. This is because the United States has already mined its most accessible and least expensive uranium while such resources are still plentiful abroad.

Of course, development and export policies of other producer countries could affect the actual availability and prices of uranium exports to the United States, with attendant impacts on the outlook for the domestic industry. Also, self-restraint on import purchases by the domestic utilities could continue and thus lessen the potential impact. Unless we have severely underestimated the future cost of foreign production relative to that in the United States, however, producers of foreign uranium could exert a great deal of influence on the domestic market in the long term. They would have the ability to offer uranium at prices that would undercut many domestic producers, such that imports could comprise two-thirds of the domestic market by the end of the century.

The alternatives to current policy examined in the EIA study can be grouped by three classes of impacts—those which impact the near term, those which impact the longer term, and those which have little prospect of major impact.

In the near term of 6 to 8 years, the industry's problem is one of oversupply—or underdemand, as seen from a different perspective. Option 5, the enrichment services transactions, and option 7, Federal stockpiling, both act to increase demand during this critical period. The former option, increasing the enrichment plant transaction tails assay to 0.25 percent U^{235} from its current 0.20-percent value, could increase annual demand by around 10 percent, or 2,000 tons, beginning in 1984. The Federal stockpiling option could increase demand by whatever level would be desired by policymakers, consistent with budget restrictions.

Either option could result in an estimated market price increase of $2 per pound for each 1,000 tons of annual demand added in the near term. However, the market is likely to react primarily by increasing the rate of inventory drawdown rather than increasing production, and thus any positive effect on producers might occur much later. In the long run, demand increases induced by a continuation of these options would be balanced by equal increases in domestic production and imports.

The next class of options—those with primary impacts in the longer term beyond 8 years—is comprised of option 3, the import ceiling, and option 4, import tariffs. Neither of these options impacts domestic production in the near term because these options are directed at imports, and imports are not the problem in the near term. On the other hand, the market signal that low-cost imports will not be available typically would induce a price rise beginning in the mid 1980's.

For the import ceiling option, three levels were analyzed—20, 30, and 40 percent of domestic demand. These limits could become the actual import levels in the long term because producers of foreign uranium, by virtue of low production costs, could adjust their sales prices to capture the maximum allowed import share. Also, the long-term domestic market price could turn out to be higher than that for the current policy assumption by as much as $15, $25, and $50 per pound for successively more stringent ceilings. For an electric utility company, a $10 per pound increase in uranium prices would mean a one mill per killowatt-hour increase in the cost of generating electricity from its nuclear powerplant. The electric utility customer would not see the total increase on his bill; rather, he would see the share of his increase proportional to the nuclear fraction of his utility's generating system. The one mill increase compares to an average cost of 25 mills or 2½ cents per kilowatt hour of power generated by nuclear fuel in the United States in 1980.

For the other option, import tariffs in excess of $10 per pound are found to keep domestic production from declining below 12,000 tons annually in the late 1980's. To allow annual domestic uranium production increases to match annual domestic demand increases, the tariff rate would need to be doubled to $20 per pound beyond the 1980's.

In the category of policies unlikely to have significant impact, option 2, the deferred phaseout of import restrictions, proposes to hold maximum imports to the 30-percent level for typically 5 years and then resume the phased elimination of restrictions. Such an option protects the industry during a period of no threat from imports but removes the protection precisely when it could potentially be needed. Option 6, the international commodity agreement, in order to maintain a growing domestic industry, would likely result in only purchases, and not sales, of buffer stockpile material, at least over the analysis period considered. This would involve a financial commitment potentially approaching $1 billion annually over at least a 5-year period.

In summary, the dominance of natural market forces in the near term would be hard to overcome through any of these policy changes. In the longer term, the policy options which incorporate control of imports are estimated to be the ones having the largest impact on consumer prices and the uranium industry's growth.

Mr. Chairman, you also asked us to identify key indicators of the domestic uranium industry's viability that might be monitored in the future. There is considerable disagreement on how to determine the industry's viability. Rather than further muddying the water, I will just relate a 1968 Atomic Energy Commission policy statement which points to the size of the domestic market, the price of uranium, the size of domestic ore reserves, the rate of development of new reserves, the probable penetration of the domestic market by foreign imports, and the size of the export market as important factors to consider. The AEC stated its justification in 1971 for not removing import restrictions as being recognition of uranium production plans already adopted, the expected soft uranium market over the next several years, the availability of excess foreign production capability. Finally, in 1974, the AEC added national self-sufficiency in energy supplies to the list of important factors to consider in the viability question.

All except the last one of these factors are explicitly represented in our analysis system. They are not all independent parameters, however. For example, it could be argued that the availability of large surplus stocks is one determinant of an expected soft uranium market over the next several years.

The Department of Energy has a data-collection program in place to monitor many of these factors. In my judgment this program is effective, although some areas of possible enhancement are identified in the EIA analysis.

I hope the information I have provided will help you in your deliberations. I would be pleased to answer any questions you may have.

Senator **Domenici**. Thank you very much.

We are going to now hear from Mr. Marshall, Acting Assistant Secretary, Bureau of Oceans and International Environmental and Scientific Affairs, of the Department of State.

STATEMENT OF HARRY R. MARSHALL, JR., ACTING ASSISTANT SECRETARY, BUREAU OF OCEANS AND INTERNATIONAL ENVIRONMENTAL AND SCIENTIFIC AFFAIRS, DEPARTMENT OF STATE, ACCOMPANIED BY ELEANOR STEINBERG, ACTING DIRECTOR, OFFICE OF NUCLEAR EXPORT AND IMPORT CONTROL

Mr. **Marshall**. I am pleased to be here today to present the views of the Department of State on the study prepared by the Department of Energy on the domestic uranium industry and imports of uranium. Accompanying me today is Eleanor Steinberg, Acting Director of the Office of Nuclear Export and Import Control.

The State Department has the lead responsibility within the executive branch concerning international nuclear energy matters. The Bureau of Oceans Environmental and Scientific Affairs carries out this reponsibility which includes the development of nuclear cooperation and the coordination of nuclear export approvals. Nuclear cooperation including uranium imported into this country, is a matter of considerable importance in our relations with the other major suppliers and for the foreign recipients of our enrichments services.

The 1964 U.S. embargo on imports of foreign uranium for use by domestic utilities as feed material at the U.S. enrichment facilities caused a disruption in the international uranium market. Foreign producers' access to the principal consumer market, which at that time was the United States, was adversely affected. This restriction, for example, resulted in a two-tier price structure with higher prices for U.S. uranium than for foreign uranium sold outside the United States.

The imposition of this embargo in 1964 was based on the need to protect, for national security reasons, a uranium mining industry that was just beginning to emerge as a private sector enterprise. This industry had initially been launched under the protection of the U.S. Government in order to meet requirements for the defense program. Foreign producers objected to this U.S. action because many of them had launched exploration programs and opened up mines in anticipation of U.S. demand and business. The 1974 decision to begin in 1977 a gradual phaseout of the embargo over a 7-year period was, of course, well received by foreign producers and has introduced new confidence on the part of both producers and consumers in the functioning of the international uranium market. The Atomic Energy Commission took this step after careful study and congressional review but only after a finding that the import restrictions could be eased without affecting the viability of the domestic industry.

With respect to foreign producers, I would like to mention that two of the leading exporters of uranium are Canada and Australia. The United States places great value on our overall relations with these countries. I would like to emphasize, in particular, the importance we place on good relations with these countries in the area of nonproliferation. Canada and Australia have been strong supporters of U.S. policies in nonproliferation. Both Governments have come to us on more than one occasion at high levels in the past year, and have made clear to us their unhappiness with any slowdown in the schedule for phasing out the old embargo. Any move now to restrict imports of foreign uranium into the United States for use by domestic customers, would have great potential for damaging our nonproliferation cooperation with Canada and Australia.

I would also like to point out that the Canadians have informed us that they would take up the matter under the General Agreement on Tariffs and Trade [GATT], should the U.S. impose new restrictions on uranium imports. The Department of State would obviously like to avoid such a confrontation.

The principle of free trade has been a basic tenet of U.S. trade policy for many years and is certainly the policy of this administration. In the post-war era, the United States has played a leadership role in the efforts in the GATT and elsewhere to remove or reduce barriers to trade and distortions in world markets. The Department of State plays a very active role in these trade negotiations. It is our view that the introduction of measures that hamper or distort the flow of goods in world markets should be avoided. If, in exceptional circumstances, such measures are required, they should be implemented only where the evidence in support of the need for such measures is compelling, and their use accords with applicable international agreements.

In 1964, during congressional hearings on the proposed legislation to restrict uranium imports for use in domestic utilities, the Department of State was concerned about the implications for our trade policy of the proposed embargo, but felt that we could go along with the restriction as long as it was clear that the measures were purely temporary. It was felt that these temporary measures were needed because of the transition the industry was undergoing as the demand for uranium shifted away from defense programs to the commercial sector. In 1974, it was determined that the transitional phase had ended, and the restriction could be phased out.

I would like to call your attention to several of the findings of the DOE study—findings which I believe to be of key importance as we consider the overall state of the domestic uranium mining industry. In analyzing the effect of the present phaseout of the embargo, the study notes:

> Experience to date in allowing use of foreign uranium has not resulted in a large switch to foreign uranium. In 1979 some 9 percent of the feed delivery was of

> foreign origin, although 20 percent was allowed. In 1980 uranium of foreign origin amounted to 10 percent versus the 30 percent allowed.
>
> Stricter limitations on foreign uranium would provide only very limited assistance to the U.S. industry over the next 3 to 5 years, in view of the state of U.S. uranium demands, existing sales contracts, and buyer inventories.
>
> The data and findings contained in this report do not clearly point to the need to change the present course of action. DOE has currently in place a stepwise plan for removal of restrictions on enrichment of foreign uranium, on the basis that no clear or immediate threat to the industry from foreign uranium has been established. Further clarification of future uranium demands, buyer procurement policies, and foreign country export policies will continue to be needed to assure the validity of this policy.

The Department of State believes that the analysis in the DOE study fully justifies these findings. Our basic position is that we believe that the current, orderly phaseout of the embargo is working well and that foreign imports, which are at relatively low levels, are not the cause of the problem. The problem we need to attack is revitalization of America's nuclear-power industry. This administration is taking numerous steps to lay the groundwork for a broadbased and sustainable expansion of the role of nuclear power.

We therefore see no reason at this time to change the present phaseout of the embargo. At the same time, however, we agree with the DOE position that the situation in the marketplace bears watching over the next few years in accordance with the statutory responsibility in the Atomic Energy Act.

This concludes my prepared remarks. I would be happy to answer any questions with the committee may wish to ask.

Senator DOMENICI. Thank you very much.

We have three additional witnesses. Are they all here, Mr. Canfield, Mr. Gibbs, and Mr. Stevens? Would you be available if we were to adjourn at 12:30 and then call you back? I don't know that we planned that, but I think that is probably what we are going to have to do. I apologize for that. We have a vote and none of the Senators can be here after 12:30, so we will call you back afterwards.

Mr. Marshall, I assure you that I understand the role of the State Department, but I am genuinely concerned about the attitude. While there may be serious question, from what we have heard here, about the state of the industry at this point, there probably is general agreement that what we really need is to have a more dependable nuclear industry in this country. I think it is equally well established that in the not too distant future, whatever happens, we are going to be greatly dependent upon foreign uranium. It appears to me that even the witnesses who don't suggest that we do anything, agree that we are going to be tremendously dependent at a point in time, and it is not so far off in the future that we ought not be worrying about it.

I will tell you what worries me. This is not the kind of industry that you can let go down and, when that time comes that you need it, you can build it right back up. Because of the mining and the long leadtimes, there is more involved in buildup than just putting some incentives out for a strong manufacturing capability to build more plants. So it does concern me.

For instance, Mr. Marshall, let me ask you this question. You imply that we should be cautious about protecting our domestic industry from foreign competitors because of the possibility that the Canadians might push this matter under the GATT situation, the General Agreement Tariffs Trade. Does the State Department have any concern about the protectionist national energy policy being pushed in Canada? Have you asked for similar talks under GATT in this regard?

Mr. MARSHALL. You are referring to current policy. I believe I understand what you are saying. It is my understanding that that is really geared to protecting investments in Canada. This is somewhat a different matter. We view this as a trade matter on import and export of uranium, rather than protecting particular types of investments.

Senator DOMENICI. Well, I don't see that much difference, and I don't hear the State Department—maybe you have—making strong objections to that. I mean, we are always the one that says it is free trade, and as you know, we want to make sure we don't do anything to that good relationship. But it appears to me that even our best friends don't think that they necessarily have to act that way for us.

Mr. MARSHALL. I agree with you. We are not happy with the Canadian position on this. And I can be frank with you and say that there are other areas where we have some disputes with our good neighbor.

I was referring to a nonproliferation area, which, as you know, is something that is giving us all concern these days——

Senator DOMENICI. Let me agree with you then that perhaps nonproliferation and the attitude of some country on nonproliferation might be something we ought to be genuinely concerned about maintaining. But you seem to be very pleased with the fact that Australia has been a good supporter of our policies of nonproliferation. Let me just tell you, and I say this facetiously, it would appear that they are so keen on it that the Australian Labor Party has indicated that they may disallow uranium sale contracts if they are voted into power. I think that is true, isn't it?

Mr. MARSHALL. That is the policy of the Australian Labor Party, and it is true. In a way, if they take such an action they will be tending to withdraw themselves completely from the whole international uranium market. I can't really comment in any great detail on that, I am not completely familiar with the velocity of the Australian Labor Party, the current Government, of course, is working with us on a number of things, and we are continuing to rely on their help in this nonproliferation area.

Senator DOMENICI. I will be right back. I am going to vote.

[Short recess taken.]

Senator SIMPSON [presiding]. We will proceed. The chairman will be back in a moment, but I have some questions and this is an opportunity for me to usurp the powers of this committee, and I am not on this committee, so this is very enjoyable.

Let me just ask, I think it was Mr. Evered, in your testimony you mentioned the "current downward momentum," was your phrase, in activity in the domestic uranium industry would not be likely to be halted in 6 to 8 years by any of the policy options that you had analyzed.

What steps can be taken in your estimation, or could be taken to ease these current trends or at least reverse them somewhat?

Mr. **Evered**. Senator, as I indicated in my testimony, there are a couple of options that could temper the downward momentum, steps which would in some way increase the gross demand for uranium. Stockpiling is one; increasing the transaction tails assay the other. These might increase demand, but it would be difficult to conceive of totally reversing the downward momentum.

Senator **Simpson**. That is a rather grim projection, whatever computer models are used. That is certain.

Mr. Brewer, I had one other question of you, if I may.

To what extent is the present utility reliance primarily on domestic uranium suppliers due to existing contracts, commitments under contract, rather than any conscious decision to simply use the increasingly higher foreign uranium limits? I guess if that is a factor, is the threat of the foreign uranium supply an increasing problem as we move to this point of future uranium supply commitments as these contracts expire and we begin to look at the new contract commitments?

Mr. **Brewer**. Senator, as I believe I said in my statement, we see in the near term little impact of foreign imports on the viability of the domestic uranium industry. As you move into the late 1990's, we see as much as 12,500 tons per year not being covered by domestic contract.

In other words, there is a cumulative total in the 1980's of 54,500 tons which are uncontracted for. Now, most of this comes in the late 1980's.

I would like to offer a chart for the record which is not in my statement but which shows this point. Of course, as you move in time, of course, the possibility of imports having a significant impact increases. We do have requirements not covered by contract, totaling 54,500 tons in the 1980's. And you can place that in context.

[The chart follows:]

Uranium requirements not under supply contracts

Year:	*Short tons of U_3O_8*
1981	100
1982	500
1983	1,000
1984	2,600
1985	3,500
1986	3,800
1987	7,500
1988	10,600
1989	12,500
1990	12,400
Total	54,500

Mr. **Brewer**. The current production level is about 21,850 tons per year in 1980.

Senator **Simpson**. I wondered about the contract expiring times and the availability of the product from outside the United States, and the fact that I doubt that patriotism alone will keep the utilities purchasing domestic supplies if it is cheaper to buy them out of the United States. I think that that is going to lead to some interesting acceleration of purchase if we do not do something simply because of the cost factors that any utility would be looking at. It is that simple. And that causes me great concern, and I am just wondering what you are—I realize you probably will tell me you have answered that, but I see that as a very real problem unless something is done just out of the realities of the market.

Mr. **Brewer**. Well, sir, again in the past and currently, the utilities have a propensity to buy domestic, for a number of reasons. They worry about supply interruptions and that kind of thing. There has been no stampede to buy foreign sources of uranium.

Senator **Simpson**. No, but there haven't been problems like we are perceiving right here today and we know they are severe. The Governor has mentioned the possibility that some of the foreign competitors may be subsidizing the cost of their uranium production. Are any of you aware of any information that has trickled down to your offices that might indicate that our foreign conpetitors are in some way subsidizing the production costs of the industry in order to artificially bring down the price of their uranium?

Mr. **Evered**. Speaking for EIA, I would say that we have no evidence to suggest that.

Senator **Simpson**. Any other——

Mr. **Voigt**. Something else that is of interest is that currently in Australia the Federal Government has imposed a floor price whereby the industry cannot sell their uranium below that floor price. And right now it is established at $30 a pound.

Senator **Domenici** [presiding]. Is that a free market? Does that indicate that we are apt to have free market competition for the next 25 years, when we already know at this particular point that it is some kind of protection, to put a $30 floor on?

Mr. **Voigt**. I think there are several facts, Mr. Chairman, that went into that decision, one of which is the growth of the industry in Australia itself. Because of the high grade uranium that they have in Australia, they could possibly produce it at lower prices than we can produce it in the States.

Senator **Domenici**. What it is a recognition of, it appears to me, is that they do what is necessary to protect themselves. That is what it sounds like to me. Is that wrong? Is that even a plausible reason for doing it? And if it is, what leads us to believe that they won't do similar things in other directions 15 or 20 years from now when they are 56 percent of the market and we are down to 20 percent, and the rest is Canadian and vice versa.

I really think it is foolhardy for this country to assume that things are all rosy now and we ought not interfere or fool around with this international free market. We have every reason to believe that we are going to become inordinately dependent. I don't think there is anybody here that would not be terribly worried about a United States that was as dependent as you indicated.

Could we assume when that point begins to arrive that they will continue to just be nice, free marketers, no price arrangements, I just don't believe that. I don't know what we can do about it.

I know, Erich, you are a strong proponent of leaving things alone in the marketplace. I tend normally to agree with you, but is there not some concern that if we leave things as they are there could be a very logical assumption by the two major foreign exporters that they ought to build their capacity to the maximum because sooner or later they are going to really have most of the American market? That is the only aspect of this that worries me. Should we not send some other signal than that?

Mr. Evered. Mr. Chairman, I think that you have a reasonable concern, and we propose to keep a careful watch on the domestic and foreign uranium market situation and to keep you posted on developments.

Senator Domenici. Let me just ask one other question. Why did we ever in our history have limitations on imports? What was so important about us having limitations 10 years ago and not having them now? Does anybody know?

Mr. Brewer. In the early days, Senator, after the Atomic Energy Act of 1954, it was necessary to shield and protect and create a uranium industry.

Senator Domenici. Why?

Mr. Brewer. Well, it was an infant industry, and the Atomic Energy Commission had that as a policy. The lifting of the restrictions was announced, I believe, in 1974.

Senator Domenici. That's right.

Mr. Brewer. The schedule began in 1977, 1978 and 1979.

Senator Domenici. It seems to me there was a very good American justification for the U.S. Government to control the supply of uranium, which was a basic effort at that point to control the price. The Federal Government was wanting control of the supplies, but it doesn't make too much sense to me that a very logical part of that was that they wouldn't buy and control foreign supplies. That would have produced the same situation that we presently think is all so wonderful. They would have had control and ownership of part of the supplies from Australia or Canada. Those countries would have had to sell their supplies to the Federal Government. We didn't want to do that then.

Now we have a basic industry, and we want to let the basic industry go down the tube. Viable and unhealthy doesn't make much sense. As I read your statement, Mr. Secretary, it is on the way down. I don't know how far down it has to go for somebody to say it isn't a very good situation for America.

Mr. Evered. Mr. Chairman, I think it is important to divorce the concern for the possibility of our becoming too dependent on imported uranium from the causes of the current economic woes of the domestic uranium industry.

Senator Domenici. Oh, I understand.

Mr. Evered. Which is the depressed market.

Senator Domenici. Well, I agree wholeheartedly, but it would appear to me but for the fact that we have some very long-term contracts that even if the market was stronger with more demand, the projections that you give of a possible 80–20 situation exists whether we are depressed or whether we are booming.

Mr. Evered. That is correct, because of the relative cost of producing uranium in the United States versus abroad.

Senator Domenici. So it seems to me, that all we would have 15 years from now is a very, very healthy nuclear industry with a very large demand that would then be very dependent on foreign suppliers. and if we stay on the path we are on we will have a very small nuclear industry, very healthy, 80-percent dependent, and I don't really see any difference in the final product, the result, if one is concerned about that degree of dependence. Do you?

Mr. EVERED. I see your point.

Senator DOMENICI. I had a number of questions for you, Secretary Brewer, but I will just give them to you and we will hear from the uranium industry people this afternoon. I am going to yield to Senator Simpson for additional questions.

Senator SIMPSON. The point that the chairman makes is a very real one, and that is the key to his extraordinary success in this place. He wades through the stuff and gets to a number of things. Another issue would be simply if you had a few bucks and decided to invest it in uranium mining, would you put it right now in the United States or in a foreign country that produces uranium? How is that for a question? You have the bucks to invest, and they are your bucks, where would you put them with what you know about the industry, and you know a lot?

Mr. EVERED. Are you directing that question to me, sir?

Senator SIMPSON. Yes, I will direct that to you.

Mr. EVERED. I would have to beg the question and say I might not put it into uranium exploration or mining at all.

Senator SIMPSON. Given your investment capabilities, in this hypothetical question, where would you put it?

Mr. EVERED. The prospects for return on investment in domestic uranium production would be unattractive relative to foreign production.

Senator SIMPSON. Let me ask Mr. Brewer, and I, too, will submit questions in writing.

You have placed great emphasis on the fact that the present utility use of foreign uranium is on the average well below the present foreign enrichment limits. Are there any utilities at the present time that are presently using foreign uranium at the 1980 allowable level of 30 percent, or at the 1981 level of 40 percent?

Mr. BREWER. The industrial averages, I believe, are less than 10 percent out of the allowable 40 in 1980. Is your question, "Are there individual utilities which are above?"

Senator SIMPSON. Yes.

Mr. BREWER. The answer is, yes.

Senator SIMPSON. How many?

Mr. VOIGT. I believe for 1980 the number is eight, Senator, but we can supply that for the record.

Senator SIMPSON. If you will, I would appreciate your furnishing the names of those utilities.

[The names follow:]

DOMESTIC UTILITIES THAT HAVE DELIVERED THE ALLOWABLE 30 PERCENT FOREIGN URANIUM TO THE DOE ENRICHMENT PLANS IN 1980

Carolina Power and Light Co., Commonwealth Edison Co., Connecticut Yankee, Indiana and Michigan Electric, Maine Yankee Atomic Power Co., Sacramento Municipal Utility District, Southern California Edison Co., and Vermont Yankee Nuclear Power Corp.

Senator SIMPSON. I thank you, Mr. Chairman. It is a toughy and it is very real, and even though, obviously, it affects the State that you represent and I represent, it would be easy to say that I function here in a totally provincial capacity and tended to do so because again I have been given the responsibility of chairing the Subcommittee on Nuclear Regulations, and so it is a national scope, but it comes to dependency, it comes to a healthy industry in America, it comes to just issues of plain old business sense that we will be grappling with. Thank you very much.

Senator DOMENICI. Thank you, Senator.

Let me ask one additional question. Before I do so I want to put in the record a letter directed to me as chairman, from the Ambassador of Australia. I will just read for the record the summary:

> Australia cannot emphasize too strongly the seriousness with which it would regard any proposal to modify current policy on withdrawl of import restrictions. Any modification of policy would be inconsistent with public policy positions taken by the U.S. administration, and could have serious consequences for the international nuclear industry both within and outside the United States, where both producers and consumers have been planning on the basis of announced United States policy.

We will make that part of the record.

[The letter follows:]

EMBASSY OF AUSTRALIA
WASHINGTON, D. C.

Ambassador

Sir Nicholas Parkinson

22 September 1981

My dear Mr Chairman,

Your Committee is to commence hearings on 25 September 1981 on the findings of the Department of Energy and the Energy Information Administration studies into the domestic uranium industry in the United States in order to review current policy on restrictions on the importation of foreign uranium for use by United States utilities.

I should like to convey to you and your Committee that the Australian Government does not believe it would be appropriate for the United States to change its existing policy and arrangements to phase out uranium import restrictions for the following reasons:

International/Bilateral Aspects

Australia has noted the statements and actions of the current United States Administration in support of trade liberalisation and the avoidance of Government intervention leading to market distortions and resource misallocation. Any action to change current United States policy so as to further restrict foreign uranium imports would be inconsistent with the tenor and direction of United States economic policies in general and its international (GATT) commitments in particular. The Australian Government and industry would regard very seriously any action which led to further distortion of the market.

The recent development of the Australian uranium production industry and of the world uranium industry generally has proceeded against the background of the anticipated normalisation of the United States uranium market by 1984. Uncertainties resulting from any decision to maintain or increase restrictions on access to the largest commercial uranium market in the world would have considerable effects on the willingness and ability of the Australian uranium industry to undertake the large investments on exploration and development necessary to ensure it is in a position to make its proper contribution to the international supply of

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Senator Pete V. Domenici
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energy resources. In this regard United States companies have significant interests in Australian and other foreign uranium ventures.

The Australian Government has long considered the lifting of the restrictions on foreign uranium imports into the United States as a prerequisite to normalising the international uranium market in the interest of both producers and consumers alike. It has also viewed the current United States policy to phase out the restrictions in this light. Any departure from the announced policy by the United States would constitute a return to the unpredictable policies of the late 1960s and early 1970s. These led, in the view of the Australian Government, to many of the difficulties that subsequently affected the stability of the international uranium market and the related issue of assurance of uranium supplies worldwide.

Such linkages were acknowledged by the International Nuclear Fuel Cycle Evaluation in its Working Group Report dealing with assurances of supply. It observed that "A United States embargo imposed in the 1960s .... had a serious effect on the remainder of the world uranium mining industry, and tended to endanger the longer term assurances of supply by threatening the viability of mining enterprises elsewhere."

Australia wishes to play its part in supplying the world's essential energy requirements. Indeed in announcing the Australian Government's 1977 decision to proceed with the mining, milling and export of uranium, the Prime Minister said that one of the fundamental considerations leading to the decision was "the need to supply essential sources of energy to an energy deficient world."

Australia believes that any change of policy relating to foreign uranium imports to the United States would impair predictability in the marketplace, adversely affect assurance of supply considerations internationally (which the United States Government will appreciate are very sensitive) and detract from the objectives otherwise shared between Australia and the United States.

Department of Energy Studies

Australia has noted recent Department of Energy studies on the United States domestic uranium industry and the thrust of the overall findings, i.e., that a change of current policy on foreign uranium imports:

(I) would not have a significant impact on the current state of the United States domestic uranium industry in the short term,

(II) could have significant implications for the price of uranium in the United States in the long term, and

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(III) would be inconsistent with United States Government statements and actions.

It also notes the findings in the Department of Energy study that "stricter limitations on foreign uranium imports would provide only limited assistance to the United States industry over the next 3 to 5 years, in view of the state of United States uranium demand, existing sales contracts and buyer inventories."

It is clear that foreign imports are not the cause of the current problems of the United States industry. The Department of Energy studies confirm this. The Department of Energy study concludes that the reasons for the current problems in the United States industry relate to deferral of domestic demand. Falling United States prices, the higher cost of money and the difficulty of justifying self-supply programs to State public utility commissions, rather than the current use of foreign uranium or the long term availability of so-called "cheap" foreign uranium. Australia agrees with these conclusions.

Foreign uranium usage has been limited and in fact imports in 1980 were less than one-third of those which would have been permitted under current policy. United States utilities have, in practice, followed a strong policy of buying United States uranium. The present situation in the United States has its origin more in delays in reactor construction and cancellations than in loss of market to foreign uranium.

Price Considerations

A number of United States producers have suggested that as long as United States utilities believe that "low cost" foreign uranium will be available on demand in the future, then they will continue to defer the commitments essential to meet their unfilled long term requirements and that this deferral of commitments will lead to a further decline in the United States production industry.

Australia as a potential major exporter of uranium wishes to see long term stability in the uranium market. Accordingly the Government seeks to ensure that prices for Australian uranium exports under long term contracts are consistent with the sustained development of the international uranium industry. References to the availability of "low cost" foreign uranium can be misleading. The Australian Government is convinced that current spot prices will neither encourage the timely development of potential new uranium deposits nor ensure the viability of sufficient production to meet the continuing requirements of the worldwide nuclear power industry.

Other Considerations

Australia has noted public comments (e.g., Nuclear Fuel) on some of the findings of the draft Department of Energy -Energy Information Administration study on the impact of various policy options suggested by the

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Department of Energy as a means of controlling foreign uranium imports, should that be considered necessary. In particular the finding that none of the first three policy options considered would significantly impact on domestic uranium production or gross revenue prior to 1990 have been noted. Reports on the Department of Energy - Energy Information Administration study also indicate that it has concluded that reductions in foreign uranium imports would not be matched on a one-to-one basis by increases in United States production. Instead, a faster inventory drawndown will occur, resulting in higher prices in the long term.

Reports on the Department of Energy - Energy Information Administration study also indicate that extension of United States uranium import controls beyond 1983 could as much as double uranium prices in the United States by the late 1990s from those likely to prevail given current policy.

Summary

Australia cannot emphasise too strongly the seriousness with which it would regard any proposal to modify current policy on withdrawal of import restrictions. Any modification of policy would be inconsistent with public policy positions taken by the United States Administration, and could have serious consequences for the international nuclear industry both within and outside the United States, where both producers and consumers have been planning on the basis of announced United States policy.

These views have also been conveyed to the Administration. A copy of this letter is being sent to each of the other members on your Committee.

Yours sincerely

Nick Parkinson

Senator Domenici. Let me direct a question to you, Secretary Brewer.

A lot has been said in terms of marketplace about the effect of price on consumers. It has been my understanding over the years that one of the unique characteristics about nuclear energy for electricity is that one of the most insignificant costs to consumers is the uranium itself. In a capital-short market the positive aspects of the industry are denigrated in that you need a lot of up-front money to build but very little money to supply and maintain. I think what I have said is correct at this point. So could you tell us just in a general way, what is the difference to consumers if uranium is $20 or $40?

Mr. Brewer. You are quite right. There are three cost components of total energy cost: The plant capital cost which is amortized, fuel cycle cost, and the operating and maintenance cost. Clearly with nuclear the capital cost dominates, and the fuel cycle cost is not insignificant, but it does not predominate. It is perhaps 25 percent of the total energy cost. Of the fuel cycle cost, the uranium supply component is still a fraction of that.

To answer your specific question, if you increase the price of uranium $10 a pound that amounts to about 1 mill per kilowatt hour out of a total of perhaps 30.

Senator Domenici. Do you agree with that, Erich?

Mr. Evered. Yes.

Senator Domenici. So from the standpoint of protecting the American consumer in the short run, if we were to attempt to protect America's capacity to mill and mine, we are talking in that dimension when we speak of a $10 a pound difference?

Mr. Brewer. Yes. It is very insensitive.

Mr. Evered. Senator, I would point out further that the 25 to 30 mil per kilowatt hour cost of generation is perhaps on the order of half the actual cost to the end consumer, and, of course, the cost of nuclear fuel would not directly impact the cost of transmission and such.

Senator Domenici. Why don't both of you, for the record, put down a couple of examples and let the committee take a look at what this really means in terms of the ultimate price to the consumer so we will have a better understanding. I think that is terribly important if we are serious about any of the approaches here, including the one I suggest, that maybe we do nothing in the short term, but send a signal that in the distant years the expectations built up by present policy might not be there. I think that might have a rather mellowing effect that would not have terrible repercussions on anyone.

[The requested information follows:]

NATIONAL AVERAGE OF NUCLEAR GENERATED ELECTRICITY COSTS AND INCREASES IN COST OF U_3O_8—GENERATING COST

[In cents per kilowatt-hour]

Cost category	1980 actual	$10 per pound increase in U_3O_8 cost	$20 per pound increase in U_3O_8 cost
Capital [1]	1.31	1.31	1.31
Operation and maintenance	.53	.53	.53

NATIONAL AVERAGE OF NUCLEAR GENERATED ELECTRICITY COSTS AND INCREASES IN COST OF U_3O_8—GENERATING COST—Continued

[In cents per kilowatt-hour]

Cost category	1980 actual	$10 per pound increase in U_3O_8 cost	$20 per pound increase in U_3O_8 cost
Fuel: [2]	.48	.57	.66
U_3O_8 cost	(.15)	(.24)	(.34)
Total generating cost	2.32	2.41	2.50
Retail price: [3]			
Residential	5.36	5.37	5.38
Commercial	5.48	5.49	5.50
Industrial	3.69	3.70	3.71

[1] A fixed charge rate of 18 percent and 11 percent is assumed for private and public utilities, respectively.

[2] Total fuel costs include cost of U_3O_8, conversion to UF_6, enrichment, fabrication, and spent fuel management.

[3] Retail prices are national averages. There are variations among individual electric utilities in both retail prices and the impact of increased uranium costs.

Source: Nuclear Power Program Information and Data, May/June 1981, Office of Nuclear Reactor Programs; Energy Information Administration, Nuclear and Alternate Fuel Division; and Monthly Energy Review, Department of Energy, Energy Information Administration, 1981.

Senator DOMENICI. Did you have anything else, Senator Simpson?

Senator SIMPSON. Thank you, Mr. Chairman, no.

Senator DOMENICI. We will reconvene as close to 2 o'clock as possible.

[Whereupon, at 12:37 p.m., the hearing was recessed, to reconvene at 2 p.m.]

AFTERNOON SESSION

Senator DOMENICI. We shall begin.

Our next witnesses are Mr. Kenneth S. Canfield, uranium policy council of the American Mining Congress; Mr. Edward Gibbs, vice president and general manager, synthetic fuels project director, Rocky Mountain Energy Co., Broomfield, Colo.; and Mr. Bill Stevens, president, Kerr-McGee Nuclear Corp., Kerr-McGee Corp., Oklahoma City, Okla.

Mr. Canfield, I have your statement. You can handle it however you want in terms of giving it or excerpting it. I hope we can finish in an hour.

You may proceed.

STATEMENT OF KENNETH S. CANFIELD ON BEHALF OF THE URANIUM POLICY COUNCIL OF THE AMERICAN MINING CONGRESS

Mr. CANFIELD. Thank you, Mr. Chairman.

I am Kenneth S. Canfield, vice president, Homestake Mining Co., and am speaking today on behalf of the uranium policy council of the American Mining Congress. Mr. Conger, the president of Homestake Mining sends his regrets. We have a meeting of our board of directors in New Mexico today which is the reason he can't be with us.

Senator DOMENICI. I am interested in that meeting, and I hope I am also pleased as to the result of the meeting. I hope nothing occurs more drastic than has already occurred.

Mr. CANFIELD. I don't think you should conclude anything about the meeting except that our directors are very interested in the uranium business.

The AMC is a national trade association of the mining companies that produce most of the Nation's metals and other minerals, including those mining and milling firms responsible for most of the uranium oxide production in the United States.

We appreciate the concern in Congress about the status of our industry, and believe these hearings on the viability of the uranium mining and milling industry are vital and timely.

First, I would like to give you our view of the condition of the U.S. uranium industry.

The domestic uranium industry is not in a healthy condition. The Energy Department Office of Uranium Resources and Enrichment, in its report of February 23, 1981, "The Domestic Uranium Industry and Imports of Uranium," in our view, indicates a much more healthy picture of the industry than is warranted by present conditions. By only using data through 1980, the report does not consider the dramatic curtailments in uranium mining and milling that have occurred so far this year. More cutbacks are still being announced by uranium producers. The report does note, however, that "there are cutbacks in exploration and production and, hence, in employment." We certainly agree with that.

A more recent view of the current situation is the results of a poll of AMC uranium-producing member companies. Twenty-six of thirty member companies polled report that the following uranium projects have been curtailed, shut down, or terminated since January 1, 1980. I think you will find these numbers are shocking as well as very illuminating: 61 uranium mines, 16 uranium mills, 42 ura-uranium development projects, and 395 uranium exploration projects.

There has been much discussion today about what has happened in the past. I think we have to look at what happens in the future and the expectations of the industry are obviously important, and I think they are indicated by the kind of curtailments or slowdowns that are indicated here.

Mine shutdowns may lead to loss of future ore reserves due to deteriorating mine conditions during the shutdown. The extent of loss depends on the length of shutdown and other factors. The loss of reserves, as you undoubtedly know, is a subject of extreme concern to mining companies, and they do not risk those reserves lightly.

DOE's Energy Information Administration has also addressed the condition of the industry in its September 1981 working draft, "The Impact of Various Federal Uranium Policies on the Uranium Market." EIA states that the industry is expected to diminish significantly over the next 6–8 years" as a result of "sparse marked demand and the pressure of excess consumer inventories." We concur in these observations.

In addition to these characterizations, I will mention additional important facts concerning the critical condition of the domestic uranium industry.

Over 8,000 of the estimated 22,000 workers in uranium mining, milling, and exploration operations have been laid off since January 1980. When production is resumed in the future, many uranium companies expect that there will be difficulty in attracting skilled workers, or additional time will be required to train or retrain workers to the necessary skill levels, as has been mentioned a number of times this morning.

Spot market prices, as reported by Nuexco, have declined from a 2,979 peak of $43.25 per pound to the current level of $23.50 per pound. In constant dollars, the price has dropped almost 60 percent in only 2 years.

Major setbacks in U.S. nuclear power development have significantly reduced the positive outlook for a viable uranium industry. The revised 1981 DOE nuclear power forecast estimates only 150 gigawatts [GWe] will be in operation in the year 2000; this represents almost a 90-percent reduction from the 1974 DOE forecast.

Long-term commitments between domestic uranium producers and buyers have decreased since the beginning of 1980. The DOE survey of U.S. uranium marketing activity, June 1981, shows that delivery commitments through 1990 total 135,800 tons of yellowcake, a reduction of 26,900 tons from data reported in a July 2, 1980, survey.

Surface drilling and exploration expenditures have declined significantly over the past 18 months. Expressed in 1981 constant dollars, total expenditures dropped from $457.3 million in 1978 to $267 million in 1980.

DOE has concluded that if these trends continue, U.S. exploration activity may not be adequate to assure that the United States will be able to meet long-term needs largely from domestic sources.

Senator Domenici. That is as a matter of quantity?

Mr. Canfield. Right.

Utility-held inventory levels approximate 55,000 tons and represent 3.8 years forward coverage—this is in contrast to the preferred inventory level of 1½ years. Many utilities have sold excess inventories, which has assisted in driving down the spot market in price.

Foreign organizations are now offering large supplies of uranium to our domestic utilities, much of it at below average operating costs here in the United States. A point to be made in this connection, these offerings which could lead to contracts, long-term contracts, can be consummated fairly quickly, and the results of these will have long-lasting effect on the industry.

Over the last several years, the cost of producing uranium in the United States has increased considerably. According to the DOE, "In view of decreasing productivity, lower ore grades, and increased health and safety regulations, uranium production costs probably have increased even more rapidly" than those of other industrial commodities.

The most significant action the Federal Government can take is to remove the unneeded, onerous barriers which are inhibiting the growth of the nuclear power industry and the domestic uranium mining and milling industry. A greater reliance on nuclear, as well as all of our domestic energy sources, is essential to realistic energy programs and to strengthen our national security.

Speaking about regulatory problems, of immediate concern to the uranium mining and milling industry are the recent regulatory efforts of the Environmental Protection Agency and the Nuclear

Regulatory Commission. These agencies have imposed and are continuing to impose requirements on uranium mills and mill tailings to protect against unproven, hypothetical risks to public health which may well be zero.

According to NRC and EPA, the primary source of potential radiation exposures from uranium mill operation is radon. Radon, a naturally occurring inert gas, is emitted in varying quantities from a number of sources, including soil, water, rocks, and building materials. The amount of radon introduced into the environment from uranium milling is acknowledged to be small in comparison to these other sources.

Both NRC and EPA admit that the risk to the public from radon emitted from uncontrolled mill tailings is extremely small. Nevertheless, NRC and EPA seek to impose requirements at an unnecessary and scientifically unsupportable level, such as a minimum cover of 10 feet of soil over tailings—all of which inflates costs without providing compensating safety benefits to anyone.

The American Mining Congress has presented extensive testimony on these regulatory problems earlier this year before both Houses of Congress. Copies of AMC's presentations to these committees are being provided to this committee for use in its deliberations.

In addition, Government uranium stockpile policies are important to the uranium industry.

At the Atomic Energy Commission authorization hearings in March 1972, AEC Chairman Schlesinger announced plans for reducing the Government surplus uranium stockpile. Under this program the AEC's enrichment plants operated at a somewhat higher tails assay, while continuing to base enrichment services transactions on a transactions tails assay of 0.20 percent.

We understand that this program has been underway for the past 8 years. There are unverified reports that additional sales are being made from certain Department of Energy enriched uranium inventories. Although such a policy may be financially beneficial to the Government, we feel strongly that sales of Government-owned uranium are seriously harmful to the domestic uranium industry in today's circumstances.

Furthermore, the AMC uranium companies suggest a comprehensive review of defense and strategic stockpile requirements by the appropriate authorities within the Government and committees of Congress. We oppose any Government stockpiling of uranium for purposes of stabilizing the market.

We also suggest a review of enrichment plant operating conditions, in particular the tails assays, which have a direct impact on uranium demand and also on the total cost of enriched uranium for enrichment customers. We believe that the Department of Energy should allow all enrichment customers the option of choosing a higher tails assay than the present 0.20 operating tails assay at the enrichment plants.

We are aware of the interest of the subcommittee in the current Federal policy of reducing the restrictions on the enriching of foreign uranium for domestic use, with no limit on imports beginning in 1984.

Your committee has received reports from DOE's Office of Uranium Resources and Enrichment and the Energy Information Administration, referred to above, which review the current policy and explore other policy options.

The uranium producing members of the American Mining Congress have differing opinions on this policy. Basically, there are two divergent views.

On one hand, a number of companies are opposed to any restriction of trade in international commerce, including uranium, unless such restrictions are the only means to protect national security. On the other hand, a number of companies would urge that DOE revise its uranium enrichment criteria to provide import limitations to assure maintenance of a viable domestic uranium industry.

In view of this lack of consensus among its member companies, the American Mining Congress does not offer any recommendations concerning the current policy on uranium imports or modifications to it.

The American Mining Congress and its members do, however, support the existing statute which gives the Federal Government authority to limit enrichment of foreign source uranium for domestic use to assure maintenance of a viable domestic uranium industry.

The U.S. uranium mining and milling industry has clearly demonstrated that it has the capability to explore for, develop, and produce a substantial share of the projected requirements of uranium for the nuclear power industry. It is essential that this industry be allowed to continue to provide necessary raw materials for this important segment of our energy and defense programs.

We are not asking for artificial stimulation for our industry. We do urge, however, that Congress and the administration review carefully the current situation in the nuclear power industry and in the domestic uranium mining and milling industry, and take the necessary actions to remove the impediments to their increased development.

Thank you, sir.

[Exhibits attached to Mr. Canfield's statement follow:]

TESTIMONY OF
GEORGE B. RICE
CHAIRMAN, URANIUM ENVIRONMENTAL SUBCOMMITTEE

Mr. Chairman and members of the Subcommittee. I am George B. Rice, Vice President, Kerr-McGee Corporation. Today, I appear on behalf of the American Mining Congress, as chairman of its Uranium Environmental Subcommittee.

The AMC is a trade association of over 600 members, which include the producers of a large proportion of the Nation's uranium.

AMC has submitted a written statement that details our concerns with recent regulatory efforts of the Environmental Protection Agency and the Nuclear Regulatory Commission that are the subject of these hearings. Because our time is limited, I will testify on only one of these regulatory efforts -- NRC's uranium mill licensing requirements which impose a host of very stringent new requirements on the uranium milling industry. The NRC has recently informed the Department of Energy that these same requirements will also be applied to that Department's disposal of mill tailings at inactive mill sites.1/

We understand the need for health, safety and environmental regulations applicable to nuclear fuel cycle operations, including uranium mills. However, such rules should reflect the actual risk to the public. We do not believe that NRC's requirements are rational or justified under the circumstances. First, NRC bases its estimates on unproven hypothetical risks which the agency admits may be zero. Second, the costs resulting from NRC's requirements far outweigh any possible benefits they may yield.

According to the NRC, the primary source of potential radiation exposure to the public, both during and after milling operations, is radon.[2/] Radon is a naturally occurring inert gas that is emitted in variable quantities from numerous sources, including soil, rocks, water, and building materials -- such as those used to construct this building. Radon from mill tailings is a tiny fraction -- far less than 1% -- of these natural sources of radon.[3/]

Even if uranium milling were totally eliminated the resulting reduction of radon in the environment would be insignificant and undetectable. Indeed, we are unaware of elevated levels of radon ever having been detected more than about one-half mile from a tailings pile.[4/]

No studies show that radon at the low levels associated with tailings will actually hurt anyone. Even NRC admits the hypothetical risk of cancer from radon is negligible. The agency has explained that it is less than 1 in 70,000,000 per year for three times the number of mills now in existence.[5/] This is a miniscule level of risk compared to other risks we all commonly accept. It is roughly equivalent to the risk from driving a few blocks in a car or from taking a few puffs on a cigarette.[6/] In fact, the agency has admitted that the public generally accepts risks far greater than those posed by tailings.[7/]

We believe NRC has overstated the risk from mill tailings. A group of experts including representatives from EPA, the Department of Energy, and Britain, Canada and Germany recently published a study indicating that the maximum risk per unit of exposure to radon is less than one-third that projected by NRC and may be zero.[8/]

To reduce these hypothetical risks, NRC regulations provide that the mill operator cover the tailings with a minimum of ten feet of earth and that the tailings pile be guaranteed to be maintenance-free until the year 3,000. This will cost both industry and the government a tremendous amount. We understand that the Department of Energy now estimates that the cost to the taxpayers to comply with stringent standards of this nature will exceed a half billion dollars, just for cleaning up the inactive mill sites. We estimate that the cost for the uranium milling industry to comply will be over a billion dollars. We believe that a recent report by the House Armed Services Committee aptly characterizes the possible expenditures; particularly if analogous standards are extended to other nuclear facilities and the Defense Department:

> "The cost to the taxpayer could be in the tens of billions of dollars, an expenditure that could, after appropriate evaluation, prove to be unnecessary."[9/]

Congress in the Mill Tailing Act directed that "reasonable" efforts be made to minimize the risks posed by mill tailings. In view of the minimal risks and excessive costs, NRC's regulations are unreasonable and hence fail to comply with the Act. In addition, NRC's regulations violate at least two other requirements of that Act.

First, because EPA has not issued general standards for active uranium processing sites, NRC's regulations are premature. Section 206 of the Mill Tailings Act directs that EPA must promulgate general standards for the protection of the public health, safety, and the environment and that NRC is then to implement these standards.[10] Under the provisions of the Mill Tailings Act, NRC's standards and attendent criteria for the management of mill tailings must await EPA's general standards.

Second, NRC's actions render meaningless the provisions of the Mill Tailings Act on state participation in the regulation of uranium milling. NRC has recently informed all Agreement States that they must adopt all of NRC's regulations or their agreements will automatically terminate in November of this year. Under the statute, Agreement States need not adopt federal requirements they find "impracticable."[11] NRC effectively voids this statutory right of Agreement States by claiming that the Commission's regulations are everywhere practicable and therefore that they must be adopted in total. Moreover, NRC's pressure on Agreement States effectively voids the provisions in the Mill Tailings Act for state proceedings on uranium mill requirements. States simply cannot hold meaningful hearings and reach considered decisions in the time demanded by NRC.[12] NRC's position is especially anomolous considering that the agency itself took five years to devise these requirements.[13] NRC should not be permitted to run roughshod over the statutory scheme.

In conclusion, we emphasize that NRC's regulations cannot be justified on a cost-risk-benefit basis. In contrast to NRC's requirements, EPA's standards will likely be established on such a basis in view of the requirements of Executive Order 12291.[14] Without relief, our members may be forced to comply, at great cost, with the NRC regulations that will soon have to be changed to conform to the EPA standards. To avoid this irrational result,[15] Congress should reaffirm its earlier intent that EPA should first issue standards. In the meantime, enforcement of NRC's regulations should be suspended until after EPA has issued its standards and until NRC has conformed its regulations to those standards.

We also suggest that Congress provide Agreement States at least two additional years in which to adopt requirements conforming to final NRC regulations to the extent practicable. To assure equality of treatment for companies operating in non-agreement States, the effective date of federal requirements should conform with the effective date of regulations in Agreement States. We believe action by Congress is advisable to assure that a lawful, workable set of requirements is devised to address the concerns posed by uranium milling. NRC's current regulations are much too extreme. They are unsupported, unreasonable, unduly costly, and, therefore, contrary to the public interest.

Thank you for this opportunity to outline our views. I would be happy to respond to any questions or requests for additional information.

Footnotes to Testimony

1/ Memorandum for Files by William M. Shaffer III (NRC) (April 14, 1981) (attached to AMC's written testimony).

2/ See NRC, Generic Environmental Impact Statement on Uranium Milling 12 (1980) (GEIS).

3/ NRC has estimated that unregulated "uranium milling radon releases . . .contribute . . .less than 0.0005% of radon released from natural soils in the United States." I GEIS at 6-68. NRC has elsewhere indicated that the total amount of radon released may be about 0.4% of natural release. I GEIS 19 (Table 5). Whichever amount is more correct, the fact remains that the total amount of radon attributable to milling is negligible.

4/ See, e.g., Shearer & Sill, 17 Health Physics 77 (1969).

5/ See I GEIS at 19. NRC's estimate is based on the assumption that there will be 53 additional 1800 MT per day uranium mills above the 23 "currently required operating model mill equivalents" in existence at the present time. I GEIS at 3. In view of the lack of evidence that low-level radiation actually causes adverse health effects, NRC is forced to rely on the linear non-threshold model for its risk estimates. The agency admits that model may overstate possible risks. II GEIS A-35. See also III GEIS at U-4. "Many radiation biologists are of the opinion that since body cells have a demonstrated capacity for repair there may well be a threshold dose [of radiation] below which the damage is much below linear, possibly zero." In the Matter of Duke Power Co. (Perkins Nuclear Station Units 1, 2 and 3), 8 NRC 87, [1975-78 Transfer Binder] Nuc. Reg. Rep. (CCH) ¶ 30,312 at p. 28569 (July 14, 1978).

6/ 46 Fed. Reg. 15167 (March 4, 1981).

7/ NRC, Draft GEIS on Decommissioning of Nuclear Facilities at 2-11 (1981) (Nureg 0586) (risk of 1 in 1,000,000 is generally regarded as "acceptable").

8/ Evans, et al., Estimate of Risk from Environmental Exposure to Radon-222 and Its Decay Products, 390 Nature 98 (March 12, 1981).

9/ H.R. Rep. No. 45, 97th Cong. 1st Sess. 23 (1981).

10/ The division in authority set forth in Section 206 is analogous to that provided for in Reorganization Plan No. 3 of 1970, 89 Stat. 2086. Indeed, NRC specifically requested Congress to preserve the split in authority established by Reorganization Plan No. 3 in enacting the legislation at issue here. NRC Chairman Hendrie opposed a bill assigning the "standard-setting task to the NRC with EPA in the consulting role," characterizing this as an "undesirable reversal of the present regulatory roles of the two agencies." Hearings on H.R. 13382, 12938, 12535 and 13049 before the Subcomm. on Energy and the Environment of the House Comm. on Interior and Insular Affairs, 95th Cong., 2d Sess. at 78 (1978); Hearings on S. 3008, 3078 and 3257 before the Subcomm. on Energy Products and Supply of the Senate Comm. on Energy and Natural Resources, 95th Cong., 2d Sess. 48 (1978).

11/ Section 204 of the UMTRC Act, amending 42 USC § 2021(o) provides that a state need only adopt standards "which are equivalent, to the extent practicable, or more stringent than" federal standards. (Emphasis added.)

12/ Section 204(e)(1) of the UMTRC Act provides that states must afford an opportunity for public participation in any rulemaking proceeding undertaken to comply with the statute. See 42 U.S.C. § 2021(o)(3). It is well established that a right of public participation must be accorded in a meaningful manner.

13/ NRC indicated that it began work on these regulations in 1975 when the Natural Resources Defense Council petitioned the agency to prepare a generic environmental impact statement to evaluate regulatory programs concerning uranium milling. NRC's Opposition to Motion for Stay at 5 in Kerr-McGee Nuclear Corporation, et al. v. NRC, et al., Tenth Circuit No. 80-2043 and consolidated cases.

14/ 46 Fed. Reg. 13193 (Feb. 17, 1981).

15/ During the formulation of the UMTRC Act, Congressman Dingell specifically admonished against exactly this kind of whipsawing. He specifically charged EPA to "come up with one set of standards . . .so that the rules won't change on operators." Hearings on H.R. 11698, 12229, 12938, 12535, 13049 and 13650 before the Subcomm. on Energy and Power of the House Comm. on Interstate and Foreign Commerce, 95th Cong., 2d Sess., at 393.

Exhibit 2

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•Executive Committee
†Honorary

June 19, 1981

Copy

The Honorable Alan K. Simpson
Chairman, Nuclear Regulation Subcommittee
Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Senator Simpson:

On June 16, 1981, the Subcommittee on Nuclear Regulation held hearings on the status of regulations under Titles I and II of the Uranium Mill Tailings Radiation Control Act of 1978, Public Law 95-604, 92 Stat. 3021. At these hearings, George B. Rice testified on behalf of the American Mining Congress as Chairman of AMC's Uranium Environmental Subcommittee. During the course of those hearings, Senator Domenici requested, on your behalf, additional information from the AMC. This letter addresses these various informational requests.

1. NRC's Interpretation of Agreement State Authority. At the hearing, NRC's witness, John Witte, indicated that Agreement States need not adopt NRC's mill lincensing regulations to the extent the States found those regulations to be impracticable. AMC agrees with this conclusion, which follows from the language in the statute that Agreement States must adopt standards that "are equivalent, to the extent practicable, or more stringent than" federal standards.

However, in letters to governors of Agreement States, NRC stated a contrary view. Former NRC Chairman Ahearne specifically informed Governor King of New Mexico that New Mexico must adopt mill tailings regulations "which are equivalent to, or more stringent than, those of the Commission."1/

1/ A copy of this letter with attachments is enclosed as Exhibit A.

As explained in an attachment to that letter:

> The Commission considers that its recently promulgated regulations are practicable to implement in Agreement States as they are based upon the analysis in the final GEIS which addressed operations in both Agreement and Non-Agreement States. The Commission regulations constitute minimum national standards.

(Exhibit A, Encl. 2, p. 1; emphasis in original)

NRC confirmed this position in its Opposition to the Motion for Stay filed in Kerr-McGee Nuclear Corp., et a. v. NRC, et al., No. 80-2043 and consolidated cases (Tenth Circuit).[2] NRC stated:

> [i]t is unreasonable to interpret the UMTRC Act as authorizing the states independently to determine the extent to which their implementation of NRC Requirements would be practicable.

Exhibit B at 27.

Furthermore, NRC claimed that it had "acted reasonably in determining that its Regulations are practicable federal standards and should be implemented [everywhere] by November 8, 1981." Exhibit B at 29.[3]

NRC's position in the oversight hearings simply does not comport with its letters to the governors of Agreement States nor with its representation to the Court of Appeals for the Tenth Circuit. In view of the apparent conflict in NRC's position, it is essential for Congress to reaffirm that Agreement States have authority to reject NRC requirements on grounds of practicability without facing automatic termination of their regulatory authority.

2. Basis for NRC's 2 pCi/m2/sec. Standard. NRC's witness at the oversight hearing also evinced confusion as to whether the two picocurie per meter squared per second (2 $pCi/m^2/sec.$) standard for radon emissions from tailings pile was based on the assumptions that the government would fail and a house would be

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[2] These proceedings involve a challenge to NRC's mill tailings regulations.

[3] A copy of the Opposition is attached as Exhibit B. A copy of the original Motion for Stay is attached as Exhibit C.

built atop the tailings pile. Hubert Miller of NRC, who was one of those persons primarily responsible for the preparation of the Generic Enfironmental Impact Statement, confirmed that the 2 pCi/m^2-sec. standard was based in part on the assumption that the government would fail and that someone would build a house directly atop the tailings pile. E.g., Transcript of Proceedings, New Mexico Radiation Technical Advisory Council Hearing, May 8, 1971, pp. 231-32.4/

3. The Benefits and Costs of NRC's Uranium Mill Licensing Regulations. NRC's regulations establish a 2 pCi/m^2/sec. radon emission standard for uranium mill tailings. To assure compliance until at least the Year 3000, a minimum of 10 feet of soil must be placed over every tailings pile.

Examination of NRC's own projections, demonstrates that the incremental reduction in health risk as radon emissions are lowered from 100 to 2 pCi/m^2/sec. is negligible:5/

Radon Level (pCi m2/sec)	Potential Health Effects	Incremental Reduction in Potential Health Effects
280 (no controls)	6.0	-
100	2.1	3.9
50	1.0	1.1
10	0.21	0.79
5	0.10	0.11
2	0.04	0.06

As shown by this table, reducing radon emissions from 50 to 2 pCi/m^2/sec. will reduce the potential health effects by 0.96 per year.

Incremental costs for compliance are also given by NRC:6/

4/ Pertinent portions of the transcript of this proceeding are attached as Exhibit D.

5/ This informatio appears in the Final General Environmental Impact Statement at Vol. I, Table 9.13 at pages 9-31.

6/ FGEIS at Vol. I, Table 12-5 at pages 12-22.

Flux Limit (pCi/m^2-sec)	Total Industry Costs ($M)	100 Years		1,000 Years	
		Cumulative Health Effects Averted	Cost per Health Effects Averted ($M)	Cumulative Health Effects Averted	Cost per Health Effects Averted ($M)
100	45.5	386	0.316	3860	0.0316
10	215	579	3.51	5790	0.351
3	306	594	11.7	5940	1.17
2	336	596	17.6	5960	1.76
1	388	598	35.1	5980	3.51
0.1	562	600	351	6000	35.1

From this table, the cost per health effect averted at the 2 picocurie level is $17.6 million with a 100 year integration period.

Comparing the two tables, for a reduction from 10 to a 2 pCi/m^2/sec., the incremental reduction in potential health effects is 0.17, while the cost per health effect is increased over 400 per cent.

Moreover, the costs of compliance with the 2 pCi/m^2/sec. standard is substantially understated in NRC's calculations. As NRC has otherwise indicated, the costs of compliance with the 2 pCi/m^2/sec. standard will be no less than $760 million and could reach $1.5 billion.7/ Even these higher estimates are not complete as NRC has ignored important cost items. For example, NRC assumes that all of the soil necessary to cover every tailings pile, such as the 200 acre Kerr-McGee site in New Mexico, will be free.

Sincerely,

Larry A. Boggs

Larry A. Boggs
Senior Counsel

7/ FGEIS, Vol. I at 3 and Table 12.1 at 12-8.

TESTIMONY OF GEORGE B. RICE

Mr. Chairman and Members of the Subcommittee. My name is George B. Rice. I am Vice President of Kerr-McGee Corporation of Oklahoma City. I am also Chairman of the American Mining Congress' Uranium Environmental Subcommittee.

I am appearing here today on behalf of the American Mining Congress, an industry trade association whose membership includes companies that mine and process a large portion of the Nation's uranium.

We express our appreciation for this opportunity to testify on matters of great importance to the domestic uranium industry. AMC has prepared a written statement that expresses the concerns of the uranium industry on the recent regulatory efforts of EPA and NRC. This statement has been submitted to the Subcommittee. We ask that it be made a part of the record in these proceedings.

Mr. Chairman, the uranium milling industry has been heavily regulated since its infancy by the Atomic Energy Commission, and later by the Nuclear Regulatory Commission and other federal agencies. The industry has also been regulated by certain states under agreements entered between NRC and those states. We understand the need for, and have not objected to reasonable regulations.

The uranium industry, however, is now confronted with a series of regulations that are unreasonable. The Environmental Protection Agency and the Nuclear Regulatory

Commission seek to impose requirements that go far beyond the needs of public health and environmental protection. These regulations are also based on unsound assumptions and on incorrect estimates of the health risks posed by uranium milling. Moreover, they endanger the ability of the domestic industry to produce this strategic material and important energy resource.

Today, in view of the time constraints, we will focus only on two of these regulatory efforts -- NRC's uranium mill licensing requirements and EPA's proposed inactive site standards.

NRC and EPA claim that the primary source of potential radiation exposures from mill operations is a radioactive gas called radon, which is a naturally occurring inert gas that is emitted in variable quantities from a number of sources, including soil, rocks, water, and building materials -- such as those used to construct this building.

The amount of radon that is released from the tailings pile, assuming no controls, is very small when compared to that released naturally into the environment from the soil and other sources. In fact, NRC projects that mill-related releases -- from approximately three times the mills now in existence -- will amount to no more than about one half of one percent of the total amount of radon released from natural soils in the United States.[1] Natural water vapor from soil and vegetation will contribute roughly sixteen times more radon than mill tailings. American farmers plowing their fields will contribute about six times as much radon to the environment as all the uranium milling projected through the end of the century.[2] In fact the amount of radon released from tailings is so slight that we are unaware of elevated levels of radon ever having been detected more than about one-half mile from a tailings pile.[3] Accordingly, even if uranium milling were totally eliminated, the resulting reduction of radon in the environment would be insignificant and undetectable.

No studies show that radon at the low levels associated with tailings will actually hurt anyone.[4] Indeed, even NRC admits that the radon risk from uncontrolled mill tailings is hypothetical and negligible. The agency says that the hypothetical risk is less than one in 70 million per year, assuming the number of mills is tripled.[5] EPA's risk estimates agree with NRC's. EPA estimates that the risk from uncontrolled inactive tailings piles are less than one in 100 million per year.[6] This is a miniscule level of risk compared to other risks we all accept. It is roughly equivalent to the risk from driving a few blocks in a car or from taking a few puffs on a cigarette.[7] In fact, the agency has admitted that the public generally accepts risks far greater than those posed by tailings.[8]

Moreover, we believe NRC has overstated the risk from mill tailings. A group of experts, including representatives from EPA, the Department of Energy, and Britain, Canada and Germany, recently published a study indicating that the maximum risk per unit of exposure of radon is less than one-third that projected by NRC, and may be zero.[9]

To address these hypothetical and negligible risks NRC has promulgated its uranium mill licensing regulations.[10] The significant requirements appear in Appendix A[11] to the NRC regulations. Appendix A imposes many stringent new requirements on both existing and new uranium mills. We especially call your attention to Criterion 6, which limits radon emanation from tailings piles to less than 2 picocuries per square meter per second above background radiation. This strict limitation is well within the natural flux range ordinarily encountered in uranium producing areas. Criterion 6 also requires that tailings be covered with a minimum of 10 feet of soil. Because NRC assumes that all our institutions will fail and that no responsible government will exist in our country in the future, the agency insists that all these requirements be met for thousands of years. Yesterday, the NRC representative, Mr. Martin claimed no recollection of the thousand year requirement for stabilization of tailings piles. In fact, Criterion Number One of NRC's Uranium Mill Licensing Requirements expressly calls for disposal to meet the

> "broad objective of isolating the tailings and associated contaminants from man and the environment during operations and for thousands of years thereafter without ongoing active maintenance."[12]

EPA has proposed disposal and clean-up standards applicable to inactive uranium processing sites that also apply a 2 picocurie per square meter per second radon emission rate for uranium tailings.[13] In addition, EPA proposes to require the Department of Energy to stabilize piles so as to meet this requirement until at least the year 3000. The Department of Energy must also comply with NRC's regulations. In testimony yesterday, the NRC representative suggested that NRC's Uranium Mill Requirements would not be applied to inactive sites for which DOE is responsible. This is again incorrect. NRC recently informed DOE that it intends to apply its uranium mill licensing regulations, including the minimum 10 feet of cover requirement, "as much as practicable" to DOE's inactive sites.[14] We are providing a copy of the NRC memorandum embodying this position for the record as a part of our written submission.

The milling industry has many objections to these regulatory efforts by EPA and NRC. I will briefly outline three of these:

First, with respect to NRC's mill licensing requirements, we object to their scope and timing. EPA should be required to promulgate its active site standards before NRC issues regulations. Reorganization Plan No. 3 of 1970[15] divided regulatory responsibility for radiation protection standards between the AEC (now NRC) and EPA. EPA is supposed to set general environmental standards and NRC to implement and enforce them at licensed facilities. The Mill Tailings Act also employs this division of authority.[16] Moreover, the Mill Tailings Act expressly provides that NRC regulations must conform to EPA standards.[17] EPA, however, has not yet issued standards applicable to active uranium processing sites. Accordingly, NRC's regulations are premature and contrary to the legislative scheme of the Mill Tailings Act. Moreover, it is unreasonable to subject DOE and industry to NRC standards, when they may be substantially different than those later promulgated by EPA.

Second, neither EPA nor NRC has engaged in a cost benefit analysis for their regulations. However, under Executive Order 12291 (46 Fed. Reg. 13193, February 19, 1981), EPA must engage in such an analysis in formulating its active and inactive site standards. We expect that the EPA standards will be significantly different from the NRC standards in view of the analysis required of EPA. Since NRC must under the Mill Tailings Act conform its regulations to EPA's standards, NRC's action in adopting requirements in the absence of EPA standards will result in unnecessary regulatory confusion and needless expense for both the Department of Energy and the domestic uranium industry.

Third, both NRC's mill licensing requirements and EPA's inactive uranium processing site standards are unreasonable when judged by the costs to comply -- if compliance is possible at any reasonable price. The cost of complying with NRC's requirements for tailings stabilization alone (using their numbers) is -- as best we can determine -- between $760 million and $1.5 billion.[18] This cost is grossly underestimated. For example, NRC assumes that the earth necessary to meet its 3 meters of cover requirement can be obtained and moved without cost.[19] The NRC representative yesterday suggested that the cost to comply with cover requirements may be only about four million dollars per mill. This is wrong. First, NRC's "prime option" is below grade disposal. NRC applies this requirement to both new and existing mills. This doubles the cost. Moreover, moving existing piles to comply with the below-grade requirement will be extremely expensive -- perhaps ten times higher than the $4,000,000 estimate quoted by NRC. Second, the Colorado Mining Association recently informed local authorities in that state that it would cost at least $55,000,000 for just two existing mills to comply with NRC's regulations.[20] My Company, Kerr-McGee, estimates that the cost to comply will range from about $20,000,000 to $100,000,000 for our mill in New Mexico. The higher figure will apply if we are required to move our tailings or to dispose of them below grade as preferred by NRC.

The cost to taxpayers of complying with EPA's inactive site regulations at the 25 inactive sites is estimated to be between 500 million and one billion dollars. This expense is extraordinary considering that the vast majority of these sites are in isolated areas and, therefore, pose essentially no risk to public health.

Mr. Chairman, Mr. Martin of NRC and Mr. Hernandez of EPA made many statements and appeared to leave many impressions which we believe are wrong. I have noted some of these in my testimony above. There is one additional point to which I invite your attention. Mr. Hernandez testified that the risk from 100 milliroentgen of radiation -- which is the average level of background radiation in this country -- is "several chances in 1000."[21] This is incorrect. There is no evidence that background levels of radiation cause any increased adverse health effects. Moreover, the current government estimate for the maximum health risk posed by 100 milliroentgens of radiation is about one chance in 100,000[22] -- several hundred times less than the risk quoted by Mr. Hernandez.

In conclusion, although the risks to public health are small, we are prepared to take reasonable actions to reduce those risks. We believe that NRC's and EPA's regulations are unreasonable and unlawful. It is for this reason that we have challenged NRC's regulations that are applicable to us in court. We believe, however, that the issues raised are an appropriate concern to this Subcommittee in performance of its oversight responsibility. We are convinced that upon examination, you will find the NRC and EPA requirements totally unjustified by the facts as well as unduly costly, and contrary to the public interest.

Thank you for this opportunity to outline our views. I would be happy to respond to any questions or requests for additional information.

ENDNOTES

[1] NRC, Final Generic Environmental Impact Statement on Uranium Milling (FGEIS) at 6-68.

[2] FGEIS at 19.

[3] See, e.g., Shearer & Sill, 17 Health Physics 77 (1969).

[4] See FGEIS at A-35.

[5] See FGEIS at 19. NRC's estimate is based on the assumption that there will be 53 additional 1800 MT per day uranium mills above the 23 "currently required operating model mill equivalents" in existence at the present time. FGEIS at 3. In view of the lack of evidence that low-level radiation actually causes adverse health effects, NRC is forced to rely on the linear non-threshold model for its risk estimates. The agency admits that model may overstate possible risks. FGEIS A-35. See also FGEIS at U-4. "Many radiation biologists are of the opinion that since body cells have a demonstrated capacity for repair there may well be a threshold dose [of radiation] below which the damage is much below linear, possibly zero." In the Matter of Duke Power Co. (Perkins Nuclear Station Units 1, 2 and 3), 8 NRC 87, [1975-78 Transfer Binder] Nuc. Reg. Rep. (CCH) ¶ 30,312 at p. 28869 (July 14, 1978).

[6] EPA, Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing sites at S-2.

[7] 46 Fed. Reg. 15167 (March 4, 1981).

[8] NRC, Draft GEIS on Decommissioning of Nuclear Facilities at 2-11 (1981) (NUREG 0586)(risk of one in one million is generally regarded as "acceptable").

[9] Evans, et al., Estimate of Risk from Environmental Exposure to Radon-222 and Its Decay Products, 390 Nature 98 (March 12, 1981).

[10] 45 Fed. Reg. 65521 (October 3, 1980).

[11] Id. 65533.

[12] See Criterion One, App. B to Part 40 at 45 Fed. Reg. 65533 (Oct. 3, 1980).

[13] 46 Fed. Reg. 2556 (January 9, 1981).

[14] Memorandum for Files by William M. Shaffer III (NRC) (April 14, 1981). The referenced memorandum is attached to AMC's written statement that has been submitted to this Subcommittee.

[15] 84 Stat. 2086.

[16] 42 U.S.C. 2021 (Supp. III 1979).

[17] *Id.*

[18] FGEIS Table 12.1 at 12-1.

[19] AMC estimates the haulage cost for 1 mile is currently $2.80 per cubic meter.

[20] Comments submitted by Colorado Mining Association to Dr. Frank A. Traylor, Executive Secretary, Colorado Board of Health, at p. 2 (June 5, 1981).

[21] Written Statement of Mr. Hernandez (before this Subcommittee) at 6.

[22] *See*, *e.g.*, NRC, Draft GEIS on Decommissioning of Nuclear Facilities at 2-11 (Jan. 1981) ("In evaluating the risk to the population from the decommissioned facility, consideration is given the BEIR Committee results which indicate that a 1 rem dose is equivalent to a risk of [1 in 10,000]"). *See also* 46 Fed. Reg. 15167 (March 4, 1981) (similar estimate by NRC). A dose of 100 milliroentgen of background radiation is equivalent to 0.1 rem. This results in a risk estimate of 1 in 100,000 for 100 milliroentgen.

Exhibit 4

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Copy

July 10, 1981

The Honorable Samuel Stratton
Chairman, Subcommittee on Procurement
and Military Nuclear Systems of the
House Armed Services Committee
U.S. House of Representatives
Washington, D.C. 20000

Re: Industry Exceptions to Testimony on Behalf of EPA with respect to Uranium Mill Tailings

Dear Chairman Stratton:

This letter is to advise the Procurement and Military Nuclear Systems Subcommittee of exceptions by the American Mining Congress ("AMC") to various assertions by Dr. John Hernandez on behalf of the Environmental Protection Agency ("EPA") in testimony before your Subcommittee on June 24, 1981.

1. EPA Assertion: "Title I of Pub. L. No. 95-604 requires the EPA to issue public health, safety, and environmental standards for hazards associated with residual radioactive materials at inactive uranium mill tailings piles." EPA Statement at p. 2.

Industry Exception: The authority referenced by EPA is set forth in Section 205 of the Mill Tailings Act, part of Title II of Pub. L. No. 95-604.

2. EPA Assertion: "The [clean-up] standard requires a reasonable assurance that:

1. The average concentration of radium 226 from uranium tailings in grasslands will not be more than 5 [pCi/gm].

2. Radioactivity inside a building due to tailings will not be more than 0.015 total [WL] and 0.02 milliroentgens/hour above background, as contrasted with the national average background of approximately 0.005 [WL] and 0.01 milliroentgens/hour. EPA Statement at 3.

Industry Exception: EPA's proposed clean-up standard would limit the average concentration of Ra-226 at processing sites to 5 pCi/gram per 5cm thickness within one foot of the surface and to 5 pCi/gram per 15cm thickness below one foot. These limits fall well within the range in which Ra-226 is customarily encountered in the natural soils where uranium is milled. These concentrations will result in a maximum exposure to a person living atop a "cleaned-up" site of only about 80 mrem per year. Draft Inactive Sites EIS at 8-23. Eighty mrem is less than the natural background level of radiation to which all persons are exposed in the United States and is far less than the amount to which persons in western mining areas (where tailings are located) are exposed. 1/ The proposed Ra-226 standard is in fact so low that it will be difficult if not impossible to achieve as an engineering matter.

1/ Average natural background radiation (cosmic, terrestrial and internal body radiation) varies from state to state between approximately 90 mrem and 180 mrem average exposure per year. Variation is caused primarily by different altitudes above sea level and by natural rock formations. Living near a granite rock formation, for example, may result in 25 to 100 mrem additional exposure per year. See Low-Level Ionizing Radiation Hearings Before the Subcommittee on Energy Research and Production and Natural Resources and Environment of the House Committee on Science and Technology, 96th Cong., 1st Sess. at 8-9 (1979); Biological Effects of Radiation, 15 Encyclopedia Britannica 382 (1979). There is no evidence that this background radiation has had any adverse effect upon the population.

EPA's proposed .015 WL standard for indoor radon is unreasonably low. DOE has recently informed EPA that 55 percent of the basements and 30 percent of the first sotories in U. S. homes exceed 0.015 WL. Letter, R. Clusen (DOE) to D. Hawkins (EPA), Feb. 15, 1980. This may understate the number of American homes with high radon concentrations. A recent study indicated that indoor radon coincentrations may commonly be in the range of 12 to 33 pCi/l (.13 WL to 1 WL using the conversion factor set forth in 10 CFR Part 20, App. B, note 3) -- levels far in excess of EPA's proposed limits. See Rundo, et al., Observation of High Concentrations of Radon in Certain Homes, 36 Health Physics 729 (1979). In addition, DOE has noted that over 30 percent of the structures already decontaminated at Grand Junction still exceed .015 WL. Letter, Clusen (DOE) to D. Hawkins (EPA), Feb. 15, 1980. See also Letter, Clusen (DOE) to Costle (EPA), June 13, 1980). EPA has offered no rationale for departing from the Surgeon General's current .05 WL standard.

> 3. EPA Assertion: "The current rate of radon release from inactive tailings [sites] is about 500 [pCi/m^2-sec]; the common natural rate is about one." EPA Statement at 4.

The common natural rate of release varies greatly depending on the soil or rock involved. Rock outcroppings in the areas where uranium is mined and milled may naturally release radon at a rate of several hundred pCi/m^2-sec.

> 4. EPA Assertion: "Total gamma radiation levels from [tailings piles and tailings dispersed by the wind] can be elevated from a few to tens of times background levels." EPA Statement at 6.

Industry Exception: EPA's estimate is off by a factor of several hundred, even for the maximum hypothetical risk projected on the basis of the conservative linear non-threshold model. The maximum hypothetical risk for one "rem" of radiation (approximately equivalent to 1000 milliroentgen) under the linear non-threshold model is 1 in 10,000. See e.g., NRC, Draft GEIS on Decommissioning of Nuclear Facilities at 2-11 (Jan. 1981) ("In evaluating the risk to the population from the decommissioned facility, consideration is given the BEIR Committee results which indicate the a 1 rem dose is equivalent to a risk of [1 in 10,000]"). See also 46 Fed. Reg. 15167 (March 4, 1981) (similar estimate by NRC). A dose of 100 milliroentgen of background radiation is equivalent to 0.1 rem. This results in a maximum risk estimate of 1 in

100,000 for 100 milliroentgen, not several chances in 1000 as asserted by EPA.

6. EPA Assertion: "EPA used a standard linear non-threshold model to determine the additional risk of the gamma radiation from the total tailings." EPA Statement at 6.

Industry Exception: Epidemiological studies unanimously indicate that a "standard linear non-threshold model" dramatically overstates the risk from mill tailings and other sources of lower level radiation. Indeed, these studies indicate that low-level radiation may be beneficial. See e.g., Hickey, et al., Low Level Zonizing Radiation and Human Mortality: Multi-Regional Epidemiological Studies, 40 Health Physics 625 (1981); Frigerio, et al., The Argonne Radiological Impact Program (ARIP)-1. Carcinogenic Hazard from Low-Level, Low-Rate Radiation (Argonne Nat'l Lab. Report ANL/ES-26, Part 1 (1973), High Background Radiation Research Groups (China) Health Survey in High Background Radiation Areas In China, 209 Science 877 (1980); Gopal-Ayengar, et al., Evaluation of the Long-Term Effects of High Background Radiation on Selected Population Groups on the Kerola Cost in Peaceful Uses of Atomic Energy, Vol. 11, Proc. 4th Inst. Conf. Peaceful Uses of Atomic Energy pp. 31-51 (1971).

7. EPA Assertion: "Tailings contain higher than normal levels of radioactivity and elevated levels of some toxic nonradioactive substances." EPA Statement at 6.

Industry Exception: Uranium mill tailings are essentially only native rock from which a significant portion of the radioactive content has been removed; their natural radioactivity has been diluted rather than enhanced by milling. See Hearings on H.R. 11698, H.R. 12229, H.R. 11938, H.R. 12535, H.R. 13088, and H.R. 13650 before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Cong. 2nd Sess. 217 (1978) (remarks by NRC Chairman Hendrie). EPA's suggestion that the tailings are abnormally radioactive is thus misleading and incorrect.

8. EPA Assertion: "Water moving through tailings may dissolve [radioactive and non-radioactive toxic] substances and carry them into groundwater or surface waters." EPA Statement at 6.

Industry Exception: According to NRC, water contamination is not a long term problem. "Since milling is currently conducted in semiarid regions where evaporation rates are far in excess of rainfall rates, it is not expected that seepage will be a long-term problem." NRC, Generic EIS on Uranium Milling (GEIS) at 12-24. See also 45 Fed. Reg. 65525 (preamble, col. 3) (Oct. 3, 1980). NRC concluded that the only possible groundwater contamination of concern from tailings involved increased levels will pose any hazard to anyone. See id. In fact, increased levels of selenium may be beneficial because of the anti-carcinogenic properties of that element as well as its importance in combatting a somes fatal cardiomyopathy (Keshan Disease) caused by selenium deficiency. See, e.g., Shamberger, Relationship of Selenium to Cancer Inst. 931 (1970); Keshan Disease Research Group, Observation of Effect of Sodium Selenite in Preventing Keshan Disease, 92(7) Chinese Med. J. 471 (1979); Collipp, et al., Cardiomyopathy and Selenium Deficiency in a Two-Year-Old Girl, 304 N. Eng. J. Med. 1304 (1981).

9. EPA Assertion: "The total present and future effect of breathing radon decay products released from open-air tailings piles at all inactive processing sites is about two deaths per year." EPA Statement at 8-9.

Industry Exception: EPA's assertion is simply wrong and furthermore manifests an unlawful preconception and bias in favor of the current form of the inactive site regulations. The projection of "about two deaths per year" is based on the linear non-threshold model, and is a maximum hypothetical risk. It is not an actual statistical risk to the population as suggested by the quotation above from EPA's testimony. Indeed, even NRC advised that "presently available epidemiological data do not conclusively rule out the possibility of zero effects at the individual low doses and dose rates involved here." GEIS at U-4. Moreover, EPA's estimate of two deaths per year overstates even the maximum risk hypothesized under the linear non-threshold model. EPA's risk estimate per unit of exposure is three to eleven times the maximum risk calculated by in Evans, et al., Estimated Risk from Environmental Exposure to Radon-222 and Its Decay Products, 390 Nature 98 (March 12, 1981). See Letter, R. Evans to W. Mills (EPA), May 27, 1981. EPA's estimate is faulty for other reasons as well. For example, EPA bases its estimates on the assumption that tailings piles result in widespread exposure to radon. However, no increased levels of radon have ever been detected more than about one-half mile from a tailings pile. See, e.g., Shearer & Sill, Evaluation of Atmospheric Radon in the Vicinity of Uranium Mill Tailings, 17 Health Physics 77 (1969) (concludes that "[t]he results indicate negligible radiation exposure of the surrounding population...").

Finally, even if the risk turns out to be two deaths out of a population of over 200,000,000, this works out to be a risk equivalent to about 1 in 100,000,000. NRC has explained that risks of this order of magnitude are "about equal" to the risks posed by "a few puffs on a cigarette, a few sips of wine, driving the family car about 6 blocks, flying about 2 miles, canoeing for 3 seconds, or being a man aged 60 for 11 seconds." 46 Fed. Reg. 15167 (March 4, 1981). The risk is without question de minimis in comparison to other risks commonly and readily incurred in our society, as summarized in the table below:

CAUSE	INDIVIDUAL RISK/YEAR
smoker	1/300
agricultural employment	1/1700
motor vehical (total, 1975)	1/4500
air pollution - sulphates	1/6700
government employment	1/9000
truck driver	1/10,000
falls	1/13,000
alcohol	1/20,000
living for 1 year downstream of a dam	1/20,000
motor vehicle (pedestrian, 1975)	1/25,000
drowning - from recreational activities	1/53,000
inhalation and ingestion of objects	1/71,000
home accidents (1975)	1/83,000
bicycling	1/100,000
person in room with smoker	1/100,000
one pint of milk per day (aflatoxin)	1/100,000
accidential poisoning (solids and liquids)	1/170,000
electrocution	1/200,000
vaccinating for smallpox (per occasion)	1/330,000
air travel - one transcontinental flight per year	1/330,000

Source: OSHA Testimony of Professor Richard Wilson reprinted in Hutt, Unresolved Issues in the Conflict Between Individual Freedom and Government Control of Food Safety, 33 FD&C L.J. 558, 564-66 and 568 (1978).

10. EPA Assertion: "[The risk of two hypothetical deaths per year] does not include what EPA believes to be the much higher risks to individuals of radon from tailings that have been dispersed or used in construction." EPA Statement at 9.

Industry Exception: EPA's Draft EIS on Inactive Sites indicates that the maximum hypothetical risk estimate of two deaths per year includes all risks. In addition, as noted in the industry exception to EPA Statement 4, EPA has elsewhere expressly noted that other hazards "are much less significant" than the risks posed by radon. The statement referenced above thus appears to be misleading and wrong.

The EPA's allusion to risks resulting from tailings used in construction is also misleading. For one thing, use of tailings in construction no longer occurs and is unlikely to recur since the Mill Tailings Act provides for government ownership and control of abandoned tailings piles. See 42 U.S.C. § 2113(b)(2) & (3). Moreover, studies have indicated that the use of tailings as fill has not resulted in any adverse health effects. One study determined that there is "no excess of leukemia cases associated with houses built on uranium mill tailings." Another advised that "no excess of lung cancer existed for that region based on available data." GEIS at A-35.

11. EPA Assertion: Experience in Grand Junction shows that practical remedial methods eliminate most of the indoor radiation that tailings produce." EPA Statement at 9.

Industry Exception: As DOE has suggested to EPA, experience in Grand Junction has shown that EPA's proposed clean-up standards are not practicable. DOE has repeatedly informed EPA that natural radon concentrations in homes typically exceed the 0.015 WL limit proposed by EPA. See, e.g., Letter R. Clusen (DOE) to D. Hawkins (EPA), Feb. 15, 1980. See also, Rundo, et al., Observation of High Concentrations of Radon in Certain Homes, 36 Health Physics 729 (1979). EPA in fact admits that naturally occurring indoor radon concentrations exceed 0.015 WL in over ten percent of the homes with basements surveyed in Grand Junction, New York and New Jersey. Draft Inactive Sites EIS at 8-27 (1980). Even more important, DOE has noted that over 30 percent of the structures already decontaminated at Grand Junction still exceed 0.015 WL. Letter, R. Clusen (DOE) to D. Hawkins (EPA), Feb. 15, 1980. See also Letter, Clusen (DOE) to Costle (EPA), June 13, 1980. Since naturally occurring concentrations of radon frequently, if not generally, exceed the level proposed by EPA for remedial action and since after remedial action the radon concentration still exceeds EPA's proposed level, it is obvious that EPA's proposed clean-up level is not practicable and is too low.

12. EPA Assertion: "Congress recognized that uranium mill tailings are hazardous for a long time, and directed EPA to set reasonable standards for their long term disposal." EPA Statement at 10.

Industry Exception: Congress did not determine that uranium mill tailings were in fact hazardous in enacting the Mill Tailings Act. Congress did not even find that mill tailings posed a hazard sufficient to necessitate regulation. Congress specifically found only that mill tailings "may pose a potential and significant radiation health hazard to the public" and accordingly provided only that "every reasonable effort [should] be made to provide for the stabilization, disposal and control in a safe and environmentally sound manner of such tailings. . . ." 42 U.S.C. § 7901(a) (emphasis added).

13. EPA Assertion: "[T]he EPA does not believe institutional control should be relied upon for periods longer than a century. They should not be used to replace adequate long-term, physical disposal methods." EPA Statement at 10-11.

Industry Exception: Although Dr. Hernandez eschewed commenting on the validity of EPA's proposed standards at page 4 of his statement, the above quoted remarks constitute a clear predisposition to reject significant alternatives to the EPA's proposals. EPA fails to provide any reason why "institutional control" is unsatisfactory. EPA's rejection of institutional control is evidently predicated upon the erroneous and unsupportable assumption that all our institutions (i.e., our government) will fail. This assumption is inconsistent with Congress' action in providing for government custody of stabilized tailings sites. Congress, in so providing, necessarily presumed that the government would persist, thus assuring the security of the sites in question. EPA's contrary assumption also contravenes our Constitution which provides for continuity of government. As Chief Justice Marshall explained in Marbury v. Madison, 5 U.S. (1 Cranch) 137, 2 L.Ed. 60 (1803), our Constitution and its principles "are designed to be permanent." This was reaffirmed by the Civil War. "[T]he Union of these States is perpetual," Abraham Lincoln declared in the course of that conflict. He added that "[P]erpetuity is implied, if not expressed, in the fundamental law of all national governments." IV *Collected Works of Abraham Lincoln* 264 (R.P. Basler, ed., 1953).

EPA's conclusory statement that institutional controls should not replace "long-term, physical disposal methods" is also without scientific support. Robley Evans, an eminent health physicist and professor emeritus of M.I.T., recently testified as follows before the New Mexico Environmental Improvement Board concerning the $2pCi/m^2$-sec radon exhalation limit adopted by NRC (and proposed by EPA):

> "I know of no scientific basis for the proposed two picocuries of radon per square meter per second. Such a standard would involve substantially more expense and more possibility of serious harm to workers and the general public due to hazards of moving large amounts of earth. And with the provisions in [the Mill Tailings Act] for federal custody of disposal sites after completion of remedial action, it would seem that a small buffer zone landscaped but without houses around a stabilized pile, would more than suffice for radiological safety.
>
> [If stabilized with a couple of feet of cover, these tailings piles] could be public parks. They could be football fields, playgrounds, baseball, tennis -- just don't dig holes in them." Testimony of Prof. Evans before the New Mexico E.I.B. at 37.

Professor Evans specifically recommended that stabilization only to control erosion. Id. at 65-66. Dr. Evans also suggested that controls adequate to last one or two hundred years are all that should reasonably be required. *See id.* at 40 ("one to two hundred years is enough").

* * * *

AMC trusts that the exceptions contained in this letter will be useful to the Subcommittee in its consideration of EPA's proposed standards for inactive sites.

Very truly yours,

George B. Rice

George B. Rice, Chairman
Uranium Environmental Subcommittee
American Mining Congress

Exhibit 5

AMERICAN
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July 5, 1981

The Honorable Samuel Stratton
Chairman, Subcommittee on Procurement
and Military Nuclear Systems of the
House Armed Services Committee
House of Representatives
Washington, D.C.

Re: Industry Exceptions to Testimony on Behalf of NRC with Respect to Uranium Mill Tailings

Dear Chairman Stratton:

This letter is to advise the Procurement and Military Nuclear Systems Subcommittee of exceptions noted by the American Mining Congress ("AMC") to various assertions by Mr. John Martin on behalf of the Nuclear Regulatory Commission ("NRC") in testimony before your Subcommittee on June 24, 1981.

1. NRC Assertion: "Title II of the [Mill Tailings] Act requires States which, under Section 274 of the Atomic Energy Act, regulate uranium mills to upgrade their programs to levels which are essentially equivalent to NRC's by November 1981." NRC Statement p. 1.

Industry Exception: NRC's assertion that the Mill Tailings Act requires Agreement States to "upgrade" their programs to conform to NRC's is incorrect. Under Section 274 of the Atomic Energy Act, various states (known as "Agreement States") are authorized to regulate uranium milling within their boundaries. 42 U.S.C. § 2021. As part of the Mill Tailings Act, enacted in 1978, Congress confirmed this authorization and provided that State regulations need be equivalent to federal requirements only "to the extent practicable." 42 U.S.C. § 2021(o)(2). NRC is unlawfully insisting that its requirements be everywhere implemented as minimum federal standards. For example, the Commission has asserted that "it is unreasonable to interpret [the Mill Tailings Act] as authorizing the states independently to determine the extent to which this implementation of NRC requirements would be practicable." Respondents' Opposition to Motion for Stay in Kerr-McGee Nuclear Corporation, et al. v. Nuclear Regulatory Commission, No. 80-2043 at p. 27 (May 4, 1981). NRC's position renders meaningless the provision in the statute for state proceedings on Mill Tailings Act requirements and reads the expression "to the extent practicable" out of the statute.

More fundamentally, Agreement States need not comply with the NRC requirements because they are totally invalid. They were adopted in advance of Environmental Protection Agency ("EPA") standards in contravention of 42 U.S.C. § 2022 and Reorganization Plan No. 3 of 1970. These authorities provide that EPA must adopt standards which NRC is then to implement. Moreover, the NRC standards (1) are not supported by the record, (2) are contradicted by recent studies indicating that exposure to radon and low-level radiation is much less hazardous than projected by NRC and may not be hazardous at all, and (3) are unnecessary to protect the public health and safety, or the environment. See Brief of AMC in American Mining Congress, et al. v. NRC, et al., No. 80-2271 (10th Cir.) (attached).

2. NRC Assertion: "The [Generic Environmental Impact Statement on Uranium Milling ("GEIS")] is a comprehensive review of uranium milling operations in both Agreement and non-Agreement States." NRC Statement p. 1.

Industry Exception: The GEIS consists of an extended analysis of a hypothetical "model mill" located in a "model region." NRC based its analysis of the alleged hazards posed by uranium milling and the effects of its regulations upon this "model mill" rather than on any existing or actually proposed facility. The record is devoid of any meaningful analysis of actual uranium milling operations in either Agreement or non-Agreement States.

3. NRC Assertion: "[T]he NRC regulations were never intended to apply to the sites being studied under the DOE program for remedial action at formerly utilized sites (FUSRAP), nor do they apply to abandoned sites covered by Title I of [the Mill Tailings Act.]" NRC Statement p. 2.

Industry Exception: Although the NRC regulations may have been developed without an intent that they be applied to inactive or abandoned sites, the Commission has recently informed the Department of Energy ("DOE") that it intends to apply those regulations to the DOE inactive sites "as much as practicable." Memorandum for File by William Shaffer III (NRC), April 14, 1981 (copy attached to AMC's written Statement).

4. NRC Assertion: "[T]ailings are large volume wastes that will remain hazardous for many thousands of years." NRC Statement p. 2.

Industry Exception: Uranium mill tailings are essentially only native rock from which a significant portion of the radioactive content has been removed; their natural radioactivity has been diluted rather than enhanced by milling. See Hearings on H.R. 11698, H.R. 12229, H.R. 12938, H.R. 12535, H.R. 13049 and H.R. 13650 before the Subcomm. on Energy and Power of the Comm. on Interstate and Foreign Commerce, 95th Cong., 2d Sess. 217 (1978) (remarks by NRC Chairman Hendrie). There are no studies or reported examples of any fatalities or injuries associated with alleged radiological hazards posed by tailings, including totally unregulated tailings piles.

5. NRC Assertion: "The estimated total volume of tailings to be generated through the year 2000 by the active milling industry is about 800 million tons." NRC Statement p. 2.

Industry Exception: NRC's estimate for total tonnage is evidently based upon that agency's projection that there will be three times as many mills in operation by the year 2000 as currently exist. See GEIS at 3 (suggesting that there will be 53 model 1800 MT per day mills in addition to the 23 "currently required operating model mill equivalents" in existence at the present time). Since 1978, only a handful of license applications have been tendered NRC or Agreement States. Of these, only a portion have been approved and only a fragment have resulted in new mills. NRC's projection concerning new mills is thus unrealistic and contradicted by actual events.

6. NRC Assertion: "Radon is a mobile, radioactive gas which is continuously released from the tailings and transported far from the point of release." NRC Statement p. 2.

Industry Exception: No increased levels of radon have ever been detected more than about one-half mile from a tailings pile. See, e.g., Shearer & Sill, Evaluation of Atmospheric Radon in the Vicinity of Uranium Mill Tailings, 17 Health Physics 77 (1969) (concludes that "[t]he results indicate negligible radiation exposure of the surrounding population . . .").

7. *NRC Assertion*: "Radioactive particulates can . . .be blown from the tailings impoundments to contaminate ground around the tailings piles and expose nearby individuals." NRC Statement p. 2.

Industry Exception: The problem to which NRC alludes is *de minimis*. EPA has explicitly stated that radiological risks (such as from particulates) other than radon "are much less significant" than the hypothetical risks posed by radon. EPA, Draft EIS for Remedial Action Standards for Inactive Uranium Processing Sites (40 C.F.R. Part 192) at 4-38. According to EPA, "[a]t most, they increase by 10% the risk estimated [from radon exposure] for the regional population and the risk to the national population is much less." *Id*.

8. *NRC Assertion*: "Large volumes of solutions containing contaminants are generated by uranium mills and these tailings solutions can seep into valuable groundwater resources." NRC Statement p. 2.

Industry Exception: NRC has indicated that water contamination is *not* a long term problem. "Since milling is currently conducted in semiarid regions where evaporation rates are far in excess of rainfall rates, it is not expected that seepage will be a long-term problem." GEIS at 12-24. *See also* 45 Fed. Reg. 65525 (preamble, col. 3) (Oct. 3, 1980). Based on NRC's model mill analysis, the Commission concludes that the only possible groundwater contamination of concern from milling involves increased levels of selenium, sulfate, manganese and iron in some groundwater. GEIS at 6- 12. NRC does not even claim in its GEIS that these increased levels will pose any hazard to anyone. *See id*. In fact, increased levels of selenium may be beneficial because of the anticarcinogenic properties of that element as well as its importance in combatting a sometimes fatal cardiomyopathy (Keshan Disease) caused by selenium deficiency. *See*, *e.g.*, Shamberger, *Relationship of Selenium to Cancer. I. Inhibitory Effect of Selenium in Carcinogenesis*, 44 J. Nat'l Cancer Inst. 931 (1970); Keshan Disease Research Group, *Observations on Effect of Sodium Selenite in Preventing Keshan Disease*, 92(7) Chinese Med. J. 471 (1979); Collipp, *et al.*, *Cardio-myopathy and Selenium Deficiency in a Two-Year-Old Girl*, 304 N. Eng. J. Med. 1304 (1981).

9. *NRC Assertion*: "Past practice of tailings use in construction of homes and as fill material has caused elevated exposure rates to occupants." NRC Statement p. 2.

Industry Exception: It is true that tailings were used as fill in certain construction activities in Grand Junction, Colorado, prior to the early 1970's. However, such use of tailings no longer occurs and is unlikely to recur since the Mill Tailings Act provides for government ownership and control of abandoned tailings piles. See 42 U.S.C. § 2113 (b)(2) & (3). In any event, the increased levels of exposure which were experienced may in fact have been within normally occurring levels given the fact that many soils naturally emanate high levels of radon. See, e.g., Rundo, et al., Observation of High Concentrations of Radon in Certain Homes, 36 Health Physics 729 (1979). Moreover, studies have indicated that the use of tailings as fill has not resulted in any adverse health effects. One study determined that there is "no excess of leukemia cases associated with houses built on uranium mill tailings." Another advised that "no excess of lung cancer existed for that region based on available data." GEIS at A-35.

10. NRC Assertion: "Only after full consideration of public and industry comments was the GEIS issued with appropriate changes in final form in October 1980." NRC Statement at 3.

Industry Exception: The path to NRC's regulations formally began in 1975 when the Natural Resources Defense Council ("NRDC") petitioned NRC to prepare a "generic environmental impact statement" to evaluate regulatory programs concerning uranium milling. The agency's initial response was a three-page Branch Position issued on May 13, 1977. That document indicates in general terms some of the stringent new requirements that NRC intended to apply to uranium mills and mill tailings. These requirements were spelled out in more detail in the Perkins nuclear reactor licensing proceeding. NRC there indicated that it intended to require a reduction in radon emanation to background levels, 6 to 20 feet of soil cover, below-grade disposal, and no on-going maintenance.[1] NRC published a rationalization for the new requirements in April 1979. The rationalization, entitled Draft Generic Environmental Impact Statement on Uranium Milling ("draft GEIS"), purportedly assessed the potential environmental impacts of uranium milling in general, and of tailings management and disposal in particular. Shortly after the draft GEIS was issued, NRC proposed the regulations at issue here. 44 Fed. Reg. 50015 (Aug. 24, 1979). After a relatively brief period for public comment[2] NRC issued the final Generic Environmental Impact Statement on Uranium Milling (September, 1980) ("GEIS"). This document essentially reiterated assertions contained in the draft GEIS. The GEIS was followed shortly by the final Uranium Mill Licensing Requirements, 45 Fed. Reg. 65521 (Oct. 3, 1980). Strangely, despite the fact that NRC halved its risk estimates and increased its cost estimates as set forth in the GEIS,[3] the Commission's final regulations are significantly more stringent in many respects than the original proposals. NRC's claim that "appropriate changes" were made in the GEIS is thus contradicted by the facts concerning its contents and development.

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[1] See In the Matter of Duke Power Company (Perkins Nuclear Station, Units 1, 2and 3), 8 NRC 87, [1975-78 Transfer Binder] Nuclear Reg. Rep. (CCH) ¶ 30,312 at p. 28668 (July 14, 1978).

> 11. NRC Assertion: The NRC regulations are "based on the long-standing principles of radiation protection . . . that radiation exposures to individuals be kept within reasonable limits and that all exposures to radiation be reduced to as low as reasonably achievable -social and economic considerations taken into account." NRC Statement at p. 3.

Industry Exception: NRC's rigid requirements go far beyond the levels necessary to protect persons even from the maximum hypothetical risk projected by NRC. For example, NRC itself has explained that persons living at the edge of a regulated pile would receive exposures "about [1/10,000] WL above background levels . . . which is a small fraction of any reasonable individual health protection limit." Draft GEIS at 12-12 (emphasis added). In fact, the exposure is about 1% of the Surgeon General's guidelines, or 100 times as stringent as necessary for a realistic worst case situation. So far as industry can tell, NRC failed to analyze the economic impact of its regulations on any existing or actually proposed facilities. On the contrary, industry understands that NRC evaluates the need for controls independent of considerations of cost to comply. NRC's statement that its regulations comport with reasonable limitations on human health exposure, costs considered, is thus doubly erroneous: the agency's regulations do not impose reasonable exposure limits and they ignore costs.

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[2] NRC denied a request by industry for more time to file comments so that industry could have an opportunity to obtain and review data that NRC indicated was "in preparation."

[3] Compare, e.g., I Draft GEIS at 15, 18 (Tables 4 and 5, respectively) with I GEIS at 16, 19 (revised Tables 4 and 5, indicating increased cost estimates and reduced projections of risk).

> 12. NRC Assertion: "There [are] two [regulatory] options: apply concentration dose limits at a fenced boundary around disposal sites which are perpetually maintained by the government or provide isolation and containment of the tailings in a manner which avoids the need for ongoing active maintenance by the government." NRC Statement p. 3.

Industry Exception: NRC is posing a false dichotomy. First, there are many alternatives to the two suggested by the agency. For example, NRC could establish a buffer zone around the pile and require sufficient cover to control erosion. Moreover, although NRC implies otherwise, the alleged alternative of containment without active maintenance in fact does not exist by the Commission's own admission because NRC is requiring each milling company to contribute a minimum of $250,000 (1978 dollars) to the Treasury allegedly to defray on-going maintenance and surveillance at disposal sites. See 45 Fed. Reg. 65535 (Criterion 10).

> 13. NRC Assertion: "[A]ny solution which requires intervention by the government essentially forever to keep people away from tailings sites and maintain the site is only a partial, expedient solution. In view of the longevity of the hazards involved, it is an extremely uncertain and expensive one." NRC Statement at 3-4.

Industry Exception: NRC offers no support for the proposition that regulations requiring on-going care would be more expensive than the allegedly permanent disposal scheme NRC has adopted. Industry estimates that the regulations relying on on-going maintenance would cost about 10 to 20% the amount of NRC's current regulations, even if the ongoing maintenance were fully funded. NRC's assertion that on-going care is "uncertain" translates into an assumption that our institutions (i.e., our government) will fail. This fear on the part of the Commission does not comport with the concept of national government and the firmly established principle that the United States is a Union of States established for perpetuity. As Chief Justice Marshall explained in Marbury v.

Madison, 5 U.S. (1 Cranch) 137 (1803), our Constitution is "designed to be permanent." President Lincoln led the nation through a Civil War to confirm this principle. As Lincoln declared, "the Union of these States is perpetual. Perpetuity is implied, if not expressed, in the fundamental laws of all national governments." IV Collected Works of Abraham Lincoln 264 (R.P. Basler, ed. 1953). NRC's plans for disposal for "thousands of years" are far more "uncertain" than a scheme involving government control. As noted above, inconsistently with the implication in the quoted statement, NRC's regulations presume perpetuity of the government. The agency specifically provides for a levy of a minimum of $250,000 (1978 dollars) against all mills allegedly for the purpose of perpetual surveillance by the government. See 45 Fed. Reg. 65535 (Criterion 10).

14. NRC Assertion: "Tailings disposal must be accomplished primarily by durable physical barriers such as earthen covers which are protected from erosion." NRC Statement at 4.

Industry Exception: NRC's conclusory statement regarding cover requirement is without scientific support. Robley Evans, an eminent health physicist and professor emeritus of M.I.T., recently testified as follows before the New Mexico Environmental Improvement Board concerning the NRC tailings disposal regulations:

> I know of no scientific basis for the proposed two picocuries of radon per square meter per second. Such a standard would involve substantially more expense and more possibility of serious harm to workers and the general public due to hazards of moving large amounts of earth. And with the provisions in [the Mill Tailings Act] for federal custody of disposal sites after completion of remedial action, it would seem that a small buffer zone landscaped but without houses around a stabilized pile, would more than suffice for radiological safety.
>
> [If stabilized with a couple of feet of cover, these tailings piles] could be public parks. They could be football fields, playgrounds, baseball, tennis -just don't dig holes in them" Testimony of Prof. Evans before the New Mexico E.I.B. at 37.

15. NRC Assertion: "[T]he approach [taken by NRC] is consistent with the specific mandate of [the Mill Tailings Act] that

> every reasonable effort is to be taken to stabilize tailings in a way that prevents or minimizes radiation emissions and other tailings hazards and, if practicable, do so in a way that eliminates long-term maintenance and monitoring." NRC Statement at 4.

Industry Exception: Nothing in the Mill Tailings Act provides that "every reasonable effort" be taken to "minimize[] adiation emissions." Indeed, Congress did not even find that ill tailings actually posed a hazard necessitating regulation. Congress specificlly found only that mill tailings "may pose a potential and significant radiation health hazard to the public" and accordingly provided only that "every reasonable effort [should] be made to provide for the stabilization, disposal, and control in a safe and environmentally sound manner of such tailings . . . ." 42 U.S.C. § 7901(a) (emphasis added).

Epidemiological studies unanimously indicate that low-level radiation such as that to which the public may be exposed from mill tailings is not harmful and, indeed, may be beneficial. See, e.g., Hickey, et al., Low Level Ionizing Radiation and Human Mortality: Multi-Regional Epidemiological Studies, 40 Health Physics 625 (1981); Frigerio, et al., The Argonne Radiological Impact Program (ARIP)-1. Carcinogenic Hazard from Low-Level, Low-Rate Radiation (Argonne Nat'l Lab. Report ANL/ES-26, Part 1) (1973); High Background Radiation Research Group (China), Health Survey in High Background Radiation Areas in China, 209 Science 877 (1980); Gopal-Ayengar, et al., Evaluation of the Long-Term Effects of High Background Radiation on Selected Population Groups on the Kerala Coast in Peaceful Uses of Atomic Energy, Vol. 11, Proc. 4th Inst. Conf. Peaceful Uses of Atomic Energy, pp. 31-51 (1971). Indeed, even NRC admits that "presently available epidemiological data do not conclusively rule out the possibility of zero effects at the individual low doses and dose rates involved here." GEIS at U-4. In any event, the costly controls specified by NRC can hardly be viewed as "reasonable," particularly in light of the de minimis risk which even NRC admits is associated with mill tailings.[4]

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[4] According to NRC's calculations, the risk from radon from unregulated tailings is only about 2.9 in 210,000,000, or roughly 1 in 70,000,000 for three times the number of mills

(footnote cont'd)

16. NRC Assertion: "The [NRC] regulations are written primarily in the form of performance objectives because the problem of tailings management is highly site specific and flexibility is needed." NRC Statement at 4.

Industry Exception: Industry certainly agrees with the concept that flexibility is required in the area of tailings management. The problem is that the NRC regulations are inflexible. They contain a host of rigid requirements, none of which are justifiable in terms of desirability for purposes of protection of health, safety, or the environment. For example, the NRC regulations, among other things,

- demand that tailings disposal be in such a fashion so as to require "no active maintenance . . .to preserve conditions" (Criterion 1 and 12);
- specify that the "prime option for disposal of tailings is placement below grade" (Criterion 3);
- totally prohibit any "deterioration of existing groundwater" regardless of the reason (Criterion 5);

(footnote cont'd)

now in existence. See GEIS at 19. NRC has elsewhere explained that risks of this order of magnitude are "about equal" to the risks posed by "a few puffs on a cigarette, a few sips of wine, driving the family car about 6 blocks, flying about 2 miles, canoeing for 3 seconds, or being a man aged 60 for 11 seconds." 46 Fed. Reg. 15167 (March 4, 1981). The risk is without question de minimis in comparison to other risks commonly and readily incurred in our society. See, e.g., OSHA Testimony of Professor Richard Wilson in Hutt, Unresolved Issues in the Conflict Between Individual Freedom and Government Control of Food Safety, 33 F.D.&C. L.J. 558, 564-66 & 568 (1978). Moreover, NRC has overstated the maximum risk posed by mill tailings. For example, NRC's risk estimate per unit of exposure to radon is more than three times the maximum risk calculated by six prominent experts in Evans, et al., Estimated Risk from Environmental Exposure to Radon-222 and Its Decay Products, 390 Nature 98 (March 12, 1981).

- provide for at least three meters of earth cover over tailings (Criterion 6);
- limit radion exhalation from the tailings to not more than 2pCi/m2-sec (Criterion 6); and .
- bar the use of self-insurance as a means of satisfying surety requirements (Criterion 9).

These rigid restrictions by their terms apply to all existing and proposed mills. No provision is made for deviation from these requirements, regardless of difficulty and expense in complying.

17. NRC Assertion: "The regulations require . . . .[t]hat siting and design criteria be observed to reduce the potential for erosion and thus achieve long-term stability of the tailings containment." NRC Statement at 5.

Industry Exception: NRC's siting and design criteria impose many unsupported, vague, and potentially costly requirements. For example, Criterion 4 calls for tailings to be located to minimize the "maximum possible flood" to which they may be subjected. The regulations do not define this concept. However, the GEIS indicates that a "maximum possible flood" is "1.4 times the PMF ["Probable Maximum Flood"] followed by a 100-year storm." GEIS at 940. As NRC notes, the whole concept of a maximum possible flood is "subjective" and "tenuous." (The same criticism applies to the underlying concept of a PMF.) Given this fact, the Commission's imposition of a maximum possible flood requirement on the industry is inexplicable.

18. NRC Assertion: "Since May of 1972, the [NRC] staff has used criteria which are virtually the same as the now effective regulations in working out tailings management programs at five new mills within NRC's jurisdiction in Wyoming and Utah and five new mills in the Agreement States Colorado and New Mexico. These ten mills, which have been licensed or are in the latter stages of licensing, have established tailings management and reclamation . programs which essentially comply with the NRC Regulations . . . . [W]e have had extensive experience in applying criteria

> like those in our regulation under a full range of conditions." NRC Statement at 5 & 6.

Industry Exception: NRC's statement quoted above evidently reflects NRC's actions pursuant to a three page Branch Position paper which the agency has employed in mill licensing since 1977. That cursory paper contains none of the rigid restrictions (some of which are noted in the Industry Exception to NRC Statement Number 16 above) which characterize NRC's lengthy Uranium Mill Licensing Requirements. NRC's experience under the Branch Position paper thus in no way suggests that mills can or will comply with the stringent new NRC regulations. NRC asserts that many new mills "essentially comply" with NRC requirements. These "complying" mills are largely hypothetical. For example, none of the new mills referenced by NRC in Colorado and New Mexico are in operation. Indeed, some are not even being constructed.

19. NRC Assertion: "The costs supplied by the industry as they developed detailed tailings management programs are consistent with those used in the GEIS cost-benefit evaluations which support our regulations." NRC Statement at 6.

Industry Exception: NRC appears to suggest that it is directly privy to the costs of complying with its regulations as part of the licensing process. This is erroneous. An NRC employee, Ross Scarano, who is heavily involved in NRC mill licensing, testified before the New Mexico Environmental Improvement Board that he is unaware of compliance costs because they are ordinarily not supplied NRC. NRC's quoted assertion is thus wihout foundation. The NRC statement appears misleadingly to suggest that the regulations are supported by a cost-benefit analysis. The GEIS specifically eschewed cost-benefit optimization as a basis for the Uranium Mill Licensing Requirements. See AMC Brief at pp. 27-43 (attached).

20. NRC Assertion: "[I]ndustry has developed economically viable methods to meet the new regulations." NRC Statement at 6.

Industry Exception: The cost to comply with NRC requirements will be excessive at many mills and will have a detrimental impact on the capacity of the domestic uranium industry. As noted in the direct testimony of the American Mining Congress, the cost to comply with NRC's tailings stabilization requirements alone range from between $760 million to $1.5 billion using NRC's numbers, and industry believes that NRC has underestimated the cost. Statement of Mr. Rice for AMC at 6-7. The Department of Energy, which is responsible for 1,000 acres of inactive sites, estimates that the cost to comply at those sites will be about a half billion dollars. This works out to about $500,000 per acre. Expenditures in this range are not consistent with economic viability.

> 21. NRC Assertion: "The [NRC] regulations have been based upon careful evaluation of tailings disposal alternatives in terms of potential health risks and costs." NRC Statement at 7.

Industry Exception: The NRC regulations are without scientific foundation. As earlier noted, Professor Evans has testified that he "knows of no scientific basis for the proposed two picocuries of radon per square meter per second" standard. Moreover, NRC rejected any strict comparison of risks averted against the costs imposed as a basis for its regulations. The various requirements specified by NRC are of obscure parentage; they are arbitrary and essentially without rationale.

> 22. NRC Assertion: In examination by this Subcommittee, the NRC representative appeared to claim no recollection of any requirement in the NRC regulations that tailings piles be stabilized for a thousand years.

Industry Exception: The whole thrust of NRC's requirements is to require disposal (e.g., below-grade) which will theoretically survive unmolested for thousands of years. NRC's Criterion Number One expressly calls for disposal to meet the

> "broad objective of isolating the tailings and associated contaminants from man and the environment during operations and for thousands of years thereafter without ongoing active maintenance." 45 Fed. Reg. 65533 (Oct. 3, 1980) (emphasis added).

* * *

AMC hopes that these exceptions will be helpful to the Subcommittee in evaluating the desirability of NRC's Uranium Mill Licensing Requirements, either as applied to active uranium processing sites or to the inactive sites for which DOE is responsible.

Very truly yours,

George B. Rice /fdb

George B. Rice
Chairman, Uranium Environmental
Subcommittee of the American
Mining Congress

Exhibit 6

RESPONSES BY AMERICAN MINING CONGRESS TO QUESTIONS PROPOUNDED BY ARMED SERVICES COMMITTEE

1. What does industry believe will be the likely cost for a uranium mill to comply with Uranium Mill Licensing Requirements?

Answer. The cost will vary depending upon a large number of factors, such as (1) whether the mill is a new or an existing facility, (2) the size of the mill, (3) whether natural features facilitate below-grade disposal (NRC's prime option), (4) whether large quantities of earth are available for use as cover (to comply with the minimum of three meters cover requirement), and so on. The cost of moving an existing pile for below-grade disposal could easily be in the $100,000,000 range. The Colorado Mining Association recently estimated that the additional cost of the Uranium Mill Licensing Requirements at two existing facilities was approximately $55,000,000. A new mill may be designed to reduce these costs. However, the additional expense necessitated by the below-grade disposal and three meters cover requirements is expected to be in the tens of millions of dollars for most such facilities.

2. Did uranium companies anticipate that reclamation requirements such as those issued by NRC would be imposed when the mills were originally built and when the contracts with the government and private purchasers for uranium were originally negotiated?

Answer. No. No one anticipated the application of stringent reclamation requirements such as those published by the NRC at the time uranium mills were constructed and contracts negotiated. Accordingly, uranium companies with existing mills were not in a position to either minimize the costs of complying with NRC's new requirements or elect not to participate in the uranium industry at all. Moreover, uranium companies with existing mills have been inhibited in efforts to spread the increased costs attributable to NRC's requirements to the purchasers of the uranium for whom the costs are incurred.

3. What is the incremental cost of reducing radon from tailings from 25 picocuries per meter squared per second to only 2 picocuries per meter squared per second?

Answer. No standard restricting radon emanation from tailings piles is necessary to protect the public health and safety or the environment. See, e.g., Testimony of Dr. Robley Evans before the New Mexico Environmental Improvement Board (June 12, 1981). Therefore, NRC's 2 picocurie emanation standard is unneccessary and unreasonable. The 2 picocurie standard will also be exceedingly costly to attain. Industry estimates it may cost an additional 10 percent per picocurie to reduce radon emanation below 25 picocuries per meter squared per second.

4. Are Agreement States currently fully regulating uranium mills and mill tailings?

Answer. Agreement States such as New Mexico have long regulated uranium mills and mill tailings. For example, New Mexico requires that mill tailings be stabilized to reduce emissions to the levels specified in 10 C.F.R. Part 20. Moreover, the State has a Continued Care Fund, to which each uranium milling company in the State contributes at least $1,000,000, for the perpetual surveillance and maintenance of tailings piles. Agreement States regulated uranium mill tailings long before NRC became involved under the Uranium Mill Tailings Radiation Control Act.

5. Are the Uranium Mill Licensing Requirements practicable in New Mexico?

Answer. No. The Uranium Environmental Subcommittee ("UES") of the New Mexico Mining Association, an association whose membership includes the uranium mining and milling companies which operate in the State of New Mexico, has demonstrated in extensive proceedings before the New Mexico Environmental Improvement Board ("EIB") that NRC's Uranium Mill Licensing Requirements are not practicable within that State. In a recent submission to the EIB, the UES explained that the NRC

> "requirements are totally unsupported. They are not required to protect either the public or the environment. They amount to regulation for regulation's sake. Moreover, they pose a grave threat to the economic feasibility of the uranium industry in New Mexico."1/

6. In formulating its Uranium Mill Licensing Requirements, NRC assumed that 55 additional mills will be built between now and 2000. As a result of slow down in reactor construction and licensing, do you believe it is realistic to assume that 55 more mills will be built?

Answer. No. Contrary to NRC's assumption, very few new mills are being licensed or, if licensed, constructed and operated. The net result of NRC's incorrect assumption that 55 more mills will be built in this century is to overestimate the risk from uranium milling by a factor of about three. This, combined with other errors in NRC's analysis in the Generic Environmental Impact Statement on Uranium Milling, casts into extreme doubt the reliability of that document and further undercuts NRC's Uranium Mill Licensing Requirements.

1/ Letter, New Mexico UES to Chairman Hensley (July 2, 1981), copy attached.

7. In devising the Uranium Mill Licensing Requirements, NRC basically assumed there would be no net imports of uranium concentrate over exports. Each year DOE allows more and more foreign uranium to be enriched in its facilities. Because of cheap labor and lack of expensive environmental controls in other countries, isn't it likely that uranium imports will increase?

Answer. The domestic uranium industry is under pressure from cheap foreign imports. Foreign producers of uranium enjoy a competitive advantage over domestic producers because of less stringent and less expensive environmental controls on uranium mining and milling in other countries. In addition, foreign producers enjoy cheaper and more abundant labor supplies. Unless steps are taken, uranium imports into this country could increase, domestic output could stagnate or even decline, and we could become dependent upon foreign sources for uranium supplies.

8. Is it true that NRC is insisting that New Mexico adopt all its Uranium Mill Licensing Requirements even if they are not practicable in the State? What will happen if New Mexico fails to adopt NRC's requirements?

Answer. Congress provided in the Uranium Mill Tailings Radiation Control Act that an Agreement State such as New Mexico need adopt lawful federal requirements applicable to mill tailings only "to the extent practicable." *See* 42 U.S.C. § 2021(o)(2). Industry believes that NRC's Uranium Mill Licensing Requirements are unlawful and need not be implemented in Agreement States even if practicable. The NRC regulations are invalid (a) because they were adopted in advance of EPA standards in express contravention of 42 U.S.C. § 2022(b) & (d); (b) because NRC has no record support for its requirements, and (c) because the NRC requirements are unnecessary to protect the public health or safety, or the environment.

NRC has nevertheless asserted that Agreement State regulations, including New Mexico's, "should be at least equivalent to that of (NRC) ... no later than November 8, 1981." NRC Memorandum and Order dated May 26, 1981, relating to 45 Fed. Reg. 65521. Moreover, in a brief filed with the United States Court of Appeals for the Tenth Circuit, NRC asserted that "it is unreasonable to interpret (the Mill Tailings Act) as authorizing the states independently to determine the extent to which their implementation of NRC Requirements would be practicable." Respondents' Opposition to Motion for Stay in Kerr-McGee Nuclear Corporation, et al. v. Nuclear Regulatory Commission, No. 80-2043 at p. 27 (May 4, 2981). NRC took a similar position in letters to the governors of Agreement States. NRC's position is inconsistent with the statute. The Commission is attempting to usurp the power of Agreement States to consider the practicability of NRC requirements (which are invalid anyway) and to adopt regulations appropriate within the states in question.

Should an Agreement State such as New Mexico fail to adopt NRC's invalid requirements by November 8, NRC is taking the position that the state will automatically lose its regulatory authority over uranium mill tailings and possibly uranium mills as well. NRC evidently intends to terminate the subject discontinuance agreements without a hearing or any other proceeding in contravention to traditional requirements under 42 U.S.C. § 2021(j). This ultimatum on the part of the Commission places undeniable coercive pressure on the states to ignore questions of practicability and validity relating to NRC's regulations.

9. Could you explain how NRC's new regulations will affect sand backfilling operations in uranium mines?

Answer. Sand backfilling refers to the practice of placing uranium mill tailings in mined-out areas (open stopes) in underground uranium mines. It is an essential practice in the State of New Mexico where it is necessary (1) to protect underground miners from collapse of adjoining mine workings[2]; (2) to safeguard aquifers overlying the mined zone from catastrophic collapse; and (3) to allow more efficient extraction of mineral values in underground workings. NRC's new regulations, however, in effect bar sand backfilling if any degradation of groundwater from its current or foreseeable uses will result, despite the significant benefits to worker safety and the environment from such operations.

10. How difficult will it be for uranium mills to comply with EPA's 40 C.F.R. Part 190 regulations?

Answer. EPA's 40 C.F.R. Part 190 regulation limits to 25 mrem the yearly exposure of the nearest resident from radioactive emissions from uranium mills, radon and its decay products excepted. Twenty-five mrem is a small fraction of ordinary background radiation which is typically 150 to 250 mrem per year in the areas where uranium is mined and milled. It is within the range of ordinary background fluctuation and extremely difficult to quantify for purposes of monitoring and measurement. Moreover, epidemiological studies unanimously indicate that the 25 mrem restriction is unnecessary to protect the public health or safety, or the environment. See, e.g., Hickey, et al., Low Level Ionizing Radiation and Human Mortality: Multi-Regional Epidemiological Studies, 40 Health Physics, 625 (1980); Frigerio, et al., The Argonne

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[2] Conventional means of securing mine roofs (e.g., mine roof bolts) are not feasible in some cases for large open stopes. In these cases, only mill tailings employed in sand backfilling operations provide a satisfactory means of stabilizing open stopes.

Radiological Impact Program (ARIP)-1; Carcinogenic Hazard from Low-Level, Low-Rate Radiation (Argonne Nat'l. Lab. Rept. ANL/ES-26, Part 1) (1973); High Background Radiation Research Group (China), Health Survey in High Background Radiation Areas in China, 209 Science 877 (1980); Gopal-Ayengar, et al., Evaluation of the Long Term Effects of High Background Radiation on Selected Groups on the Kerala Coast in Peaceful Uses of Atomic Energy Vol. 11, PROC. 4th Inst. Conf. Peaceful Uses of Atomic Energy, pp. 31-51 (1971).

AMC concurs with NRC's comments to EPA on 40 C.F.R. 190 when it was proposed initially:

> "(T)he proposed approach in 40 C.F.R. 190 emphasizes environmental monitoring, which, for the extremely low radiation levels of interest here, has been proved to be highly inaccurate even with the most sophisticated measurement devices. The inaccuracy of environmental monitoring for extremely low levels of radioactive materials can not be remedied by costly development of instrumentation because low levels of man-made radiation in the environment are small compared to levels of natural radiation. In addition, the inherent variability of climatic and other environmental conditions, including background radiation, seriously detracts from the practicality of using environmental monitoring to demonstrate

compliance with the proposed standards."
(Statement of Roger J. Mattson, Director,
Division of Siting, Health and Safeguards,
USNRC presented in EPA Hearings on Proposed
C.F.R. 190, March 8, 1976.)

It is clear 40 C.F.R. 190 is not amenable to regulatory enforcement. Yet, NRC is now proceeding to enforce the standard using the very same measurement techniques it disavowed in 1976.

Even if adequate environmental measurement techniques were available, the health risk the standard addresses is de minimis and the cost of compliance is unreasonable. AMC estimates the cost per incremental health effect averted could reach $1 billion. EPA itself has described this level of cost as "clearly (an) unreasonable burden on society." (Final EIS on 40 C.F.R. 190, Volume I, page 136.)

11. What are the most costly and troublesome features in EPA's proposed inactive sites standards?

Answer. Many aspects of EPA's proposed inactive site standards are costly and unreasonable. For example, the proposed reduction on radon exhalation to 2 pCi/m^{2}sec (parroting the NRC standard) and the proposed 1,000 year control requirement appear generally designed to support NRC's costly three-meter cover and underground disposal requirements. However, other EPA proposals, such as the 5pCi/gram radium clean-up proposal will also be extremely costly to meet. AMC understands that DOE currently estimates that it will cost about $500,000 (current dollars) per acre of tailings at inactive sites to comply with EPA's proposals. AMC estimates the costs may be as high as $1 billion.

Expanded Reply To Representative Leath's Question (Page 47, Line 1078)

Mr. Rice. By their terms, the proposed EPA inactive site standards, if adopted, will not apply to the operations which you mentioned. However, EPA has authority under the 1977 Amendments to the Clean Air Act to establish emission standards for radionuclides, such as radon. This authority is set out in 42 USC § 7422 and 42 USC § 7412. EPA added radionuclides to its list of allegedly hazardous substances on December 27, 1979 -- a first step in the eventual impositon of radon emission limitations on all industries. Sierra Club has recently sued EPA to issue such standards. Sierra Club v. Gorsuch N.D. Cal... No. 81-2436 (June 16, 1981). It is entirely conceivable that EPA, acting pursuant to this Clean Air Act authority, will attempt to extend its stringent radon emanation standard of 2 pCi/m^2-sec or a comparable standard expressed in other terms, to all industries if the agency adopts the standard for inactive sites. Many industries, including the industries which you referenced, will have a serious and costly problem meeting a 2 pCi/m^2-sec radon emanation standard.

Senator **Domenici**. Thank you very much. Could you tell me, are you really concerned that the Federal Government may be selling off more of its stockpiling now? Do you think that is deserving of further attention? Should we try to find out? We can do that if you think there is some real reason for it at this point.

Mr. **Canfield**. Yes, and I think you will hear one of the other speakers here elaborate on that a little bit more.

Senator **Domenici**. Does the stockpiling issue mean allowing all customers the option of choosing a higher tails assay than 0.20?

Mr. **Canfield**. This is a fairly complicated situation regarding terms of enrichment contracts. By allowing the customer to do this, in effect it would require more natural uranium to be used, and this would encourage some further demand, although this is not considered to be a major factor. But it would be a helpful factor in today's situation.

Senator **Domenici**. More natural uranium, you said, as compared with what? What is taking its place if you are using less natural uranium?

Mr. **Canfield**. In this case it would depend. If you do a less definitive separation job in enrichment, in effect you have higher tails assays, more uranium left over from tails, because you have to introduce more uranium as a feed into the process.

Senator **Domenici**. In other words, you would not give them as much credit for the tails assay as some are now taking, is that right? Does this mean there is less in what you have enriched?

Mr. **Canfield**. Right; as I understand, there are a few customers that have had the option and the suggestion is that this option be extended to all utilities, with the effect being to increase somewhat the demand for yellowcake.

Senator **Domenici**. While the Congress that you represent here won't take a position on the issue of importing uranium, and I don't mean to make this the single most issue, but you conclude that you do support retention of a statute that gives the Federal Government the authority that you describe on page 8. What good does it do to have that statute if, as a matter of fact, the Federal Government just doesn't want to understand what is viable and what isn't viable? Won't we just have nothing if they continue with the kind of attitude that seems to prevail?

Mr. **Canfield**. I think my answer, Senator, would be that you probably read between the lines that we have had some difficulties as an association with a number of companies reaching a consensus agreement. We did reach a consensus that we would not want to change that law. I guess from a practical standpoint it says that if the Government so chose to limit imports as a result of a finding that the industry was not viable, there would be general agreement of the member companies to do that. It is a rather indirect position, I realize.

Senator **Domenici**. How do you categorize the different opinions within the industry? What kind of companies are on which side?

Mr. **Canfield**. I don't think it would be fair to attempt to categorize who is in this category, but I think to expand, those who are for free trade, probably more people who have interests, multinational type interests, as you might expect, whereas those companies who have their activities limited primarily to the United States, as you might suspect, would tend to be in the other camp. Is that responsive?

Senator DOMENICI. It is. Now I can find out which are which from the different companies I am familiar with, and I will know, right? I thought you were going to tell me.

Let's go to the next witness.

Mr. Gibbs, we are delighted to have you here.

STATEMENT OF EDWARD C. GIBBS, VICE PRESIDENT AND GENERAL MANAGER FOR URANIUM, ROCKY MOUNTAIN ENERGY CO.

Mr. GIBBS. Thank you, Mr. Chairman.

My name is Edward C. Gibbs and I am vice president and general manager of uranium for Rocky Mountain Energy Co.

Rocky Mountain Energy (RME) is the Denver-based mining subsidiary of Union Pacific Corp. RME is principally engaged in the exploration and development of the corporation's coal, uranium, trona, and construction materials. During recent years, RME has had a role in developing U.S. uranium reserves through the operations of the Bear Creek Uranium Co. in the southern Powder River Basin in Wyoming. In addition, we have conducted exploration operations throughout the Western United States.

Before presenting my testimony, Mr. Chairman, I would like to thank you for calling this hearing to assess the condition of the domestic uranium industry. Your efforts last year have forced the administration and the uranium industry to determine whether the domestic uranium industry is healthy and capable of supplying future U.S. uranium requirements.

We have submitted written testimony for the record outlining in detail our views of the current depressed state of the uranium industry and Government actions that are required to help revitalize this industry. I won't go into all those details. I am sure we will hear much more testimony about that. In my remarks today, I would like to summarize what I feel are the key points of this testimony. I would also like to discuss my views on the psychology of the uranium marketplace and provide some insight into the planning and decisionmaking processes a producer must go through in bringing on a new mine.

I would first like to comment on the recent Department of Energy report on the domestic uranium industry and imports of uranium. We agree with the basic facts and figures brought out in this report. I would like to point out, however, that the report does not reflect the significant downturn of the industry that has occurred since January 1981.

We agree that a primary problem currently facting the U.S. industry is brought about by delays in licensing new reactors and the uncertain future of nuclear power. We also agree that the quantities of foreign uranium currently being imported to the United States do not constitute a major problem. However, as was so well brought out in the recent analysis of the industry by the Energy Information Administration, the threat of large quantities of foreign uranium becoming available in the marketplace over the next several years, in our opinion, is both a real and perceived threat to any hope the domestic industry has for recovery, at least in this decade.

It is our feeling that the current problems and decline of the U.S. uranium industry will continue until new, long-term contracts are negotiated between uranium producers and utility buyers. Given the current status of the industry, we see the following as a likely scenario.

Utilities right now are adopting a wait-and-see attitude. This is partly because of current excessive inventories, reactor licensing delays, and uncertainties relating to U.S. nuclear power development. It is also the result of plentiful uranium supplies, and most significantly, the availability of low-cost foreign uranium. In other words, even though there is significant uncovered demand in the mid to late 1980's, utilities will not begin contracting for this material for several years. During this period, the U.S. uranium industry will continue to decline and only the very low-cost producers and those with acceptable long-term contracts will remain in business.

As production centers close down, the present productive capacity of the U.S. uranium industry could easily be cut in half. Once closed, these operations will not be in a position to resume production quickly because of the necessity for revitalizing mills, pumping out mines, and hiring and retraining a work force.

In addition, the uncertainty exists that we might have to refill partially mined-out pits before we have completed mining out the ore. Thus, in the mid to late 1980's as utilities see the need to contract to supply both existing and new reactors, they will by necessity go to foreign producers. This will occur for two reasons:

First, the industry will not be capable of responding quickly to increased demand because of the time required to start up old operations; and

Second, as a result of the cost of repopening mines and mills or bringing on new production centers, domestic producers will be even further disadvantaged compared to foreign uranium which will come from existing operations.

Now, while many utilities have expressed a preference for domestic uranium supplies, they are also charged by their State regulatory commissions with the responsibility for obtaining the lowest cost fuel for their ratepayers. How much of a premium would these utilities be willing to pay? A utility buying 1 million pounds a year of uranium would be hard pressed to pay an extra $10 per pound, or $10 million per year and justify this expenditure to their PUC's or ratepayers. More likely, as is pointed out in the EIA report, this utility would diversify its foreign purchases rather than buy the higher priced domestic material.

Given this scenario, we see well over half of U.S. utility needs being fulfilled by foreign production in the late 1980's in a situation not unlike the current oil situation with OPEC.

We feel a reasonable limitation on foreign uranium for domestic end use would stimulate early negotiations between domestic producers and suppliers and maintain a viable domestic industry capable of responding rapidly to the energy needs of the Nation through the 1980's and beyond.

I have been involved in the U.S. mining industry for over 20 years. During this period I have been associated with two major companies. I would like to just mention briefly the planning and decisionmaking process which I have experienced and which I believe is not dissimilar to other U.S. companies.

Given the long lead times required to bring a uranium operation on stream—at least 6 and probably 8 years—decisions must be made today regarding production in the late 1980's. If we see a strong and growing market for uranium in this period, we will do our utmost to maintain current operations as well as beginning the years of environmental, socioeconomic, mine planning, and all the other work that must be done to bring on a new operation in this period. On the other hand, if we see an industry fraught with uncertainties, threatened by low-cost foreign production, and a steadily declining market, it is very difficult to recommend to our management and stockholders any further investments in the industry. In this context, a failure of the Government to take appropriate action will not assit in our efforts to produce uranium for the future. Merely to monitor the state of the industry, as DOE has suggested, will be to monitor the demise of the industry.

In order to maintain a reasonably viable domestic industry, Rocky Mountain Energy strongly recommends that:

The Department of Energy immediately amend existing uranium enrichment criteria by establishing a 20-percent limitation on the amount of foreign uranium a domestic utility could enrich on an annual basis for domestic end use.

That the nuclear regulatory commission expedite licensing processes for nuclear reactors in order to minimize future delays. In addition, we believe that a nuclear waste disposal program is viable.

That the Department of Energy define "viable domestic uranium industry" as one having the confidence and capability to grow and develop, sustain its position, and anticipate growth and profit over the long term to justify the risk of investment.

That the Nuclear Regulatory Commission and the Environmental Protection Agency reopen respective rulemaking proceedings to reconsider regulations significantly affecting the current state of the uranium industry.

That the Nuclear Regulatory Commission, the Environmental Protection Agency, the Department of Energy, the Department of State, and the Office of the U.S. Special Trade Representative should jointly and frequently review respective Federal policies and regulations which affect the viability of the domestic uranium industry; and the Department of Energy should undertake periodic reviews of the viability of the domestic uranium industry. It is suggested that at least every 3 years the Department of Energy thoroughly assess relevant issues affecting uranium industry viability.

Thank you very much for the opportunity to testify today.

[The prepared statement of Mr. Gibbs follows:]

TESTIMONY OF EDWARD C. GIBBS
VICE PRESIDENT AND GENERAL MANAGER - URANIUM
ROCKY MOUNTAIN ENERGY COMPANY

BEFORE THE

SUBCOMMITTEE ON ENERGY RESEARCH & DEVELOPMENT
(SENATE COMMITTEE ON ENERGY & NATURAL RESOURCES)

September 25, 1981

Mr. Chairman and Members of the Subcommittee:

My name is Edward C. Gibbs, and I am Vice President and General Manager of Uranium for Rocky Mountain Energy Company.

Rocky Mountain Energy (RME) is the Denver-based mining subsidiary of Union Pacific Corporation. RME is principally engaged in the exploration and development of Union Pacific's coal, uranium, trona, and construction materials. During recent years, RME has had a role in developing United States uranium reserves through the operations of the Bear Creek Uranium Company in the southern Powder River Basin in Wyoming. In addition, we have conducted exploration operations throughout the western United States.

Mr. Chairman, I would like to thank you for calling this hearing to assess the condition of the domestic uranium industry. Your efforts during Senate consideration of the

1980 Energy and Water Development Appropriations Act forced the Administration and the uranium industry to determine whether the domestic uranium industry is healthy and capable of supplying future U.S. uranium requirements.

Summary

A strong domestic uranium industry is essential to maintain long-term uranium and strategic interests. Nuclear power, of course, will supply an important part of future U.S. energy needs. In order to meet domestic nuclear fuel requirements and to limit U.S. dependence on foreign energy supplies, it is imperative that the U.S. maintain a domestic uranium industry that is willing to invest the necessary capital to develop domestic uranium resources.

Given the dramatic slowdown in U.S. nuclear power development and the approximate 60 percent decline of domestic uranium prices since 1979, it is understandable that the domestic uranium industry has laid off over 8,000 of 22,000 workers, limited domestic exploration activities, and significantly reduced capital expenditures based on the extremely weak U.S. uranium market. In addition, while domestic uranium production reached peak levels in 1980, it has fallen substantially throughout 1981 and can be expected to drop during the late 1980's and 1990's to levels insufficient to meet total U.S. requirements.

The domestic uranium industry is not viable.

Congress recognized the importance of maintaining a healthy uranium industry and amended the Atomic Energy Act in 1964 to require the Federal Government to not offer enrichment services for foreign uranium intended to be used as a domestic fuel source to the extent necessary to "assure the maintenance of a viable domestic uranium industry" (42 U.S.C.A., Sec. 2201(v), (1973)).

Given the current and projected non-viable condition of the industry, the Federal Government should now amend Department of Energy enrichment criteria to limit to 20 percent the amount of foreign uranium a domestic utility can enrich on an annual basis for domestic end use. In addition, in order to assure domestic uranium industry viability, the Nuclear Regulatory Commission and Environmental Protection Agency should immediately revise existing regulations and standards to provide adequate protection for public health and safety and at reasonable costs to the industry. Finally, we recommend that the Government establish nuclear waste, reactor licensing, and reprocessing programs in order to stimulate U.S. nuclear power development.

Through the Atomic Energy Act, the Federal Government has substantial authority to control development of U.S.

nuclear power capacity. The Government, therefore, has the critical role in promoting nuclear power development and a viable domestic uranium industry; the private sector cannot stimulate the industry to the extent the Federal Government can by revising nuclear and uranium policies. Appropriate Federal action should now be taken; the domestic uranium industry will respond favorably by developing domestic resources needed for long-term U.S. energy interests.

Based on the Department of Energy, the Energy Information Administration, and our own analyses of the uranium industry's viability, I believe it is fair to say that the industry is in a very critical condition and that future domestic uranium production sufficient to meet U.S. requirements is seriously in question.

United States National Security

The question of U.S. uranium industry viability relates directly to national security and economic growth. By allowing our domestic industry to deteriorate, we will incur highly disproportionate costs to re-establish production capability should any form of supply disruption occur. As we have seen from the OPEC crisis, energy independence is vital to our nation's security. Just as we cannot afford to let the state of readiness of our Armed Forces deteriorate, we must maintain a strong domestic energy capability. A viable uranium industry providing assured supplies of fuel to the country's power reactors is an integral part of our energy independence. We cannot afford the years it would take to build or rebuild a uranium production capability.

Recommended Federal Government Action

Today I plan to discuss the existing and continued non-viable condition of the U.S. uranium industry. Before discussing uranium industry viability and the uranium marketplace, however, I would like to first recommend specific Federal Government action that, if implemented, will help maintain a viable domestic uranium industry.

Rocky Mountain Energy strongly recommends that:

- The Department of Energy (DOE) immediately amend existing uranium enrichment criteria by establishing a 20 percent enrichment limitation on the amount of foreign uranium a domestic utility could enrich on an annual basis for domestic end use. This limitation should begin immediately and remain in effect until the year 2000, or until such time as the Government determines that the domestic uranium industry is viable and that increased imports of uranium will not affect the viability of the industry.

- The Nuclear Regulatory Commission (NRC) expedite licensing processes for nuclear reactors in order to minimize future delays. Delays resulting from NRC licensing procedures have been, in part, responsible for declining uranium demand; this seriously threatens the viability of the domestic uranium industry.

- The Department of Energy define "viable domestic uranium industry" as one having the confidence and capability "to grow and develop, sustain its position, and anticipate growth and profit over the long term to justify the risk of investment." Establishing this definition will assist the DOE and other federal departments when assessing whether federal policies have the effect of maintaining a viable domestic uranium industry. In addition, it will assist the Federal Government and the industry in compiling pertinent information regarding "maintenance of a viable domestic uranium industry."

- The NRC and the EPA reopen respective rulemaking proceedings to reconsider regulations significantly affecting the current state of the uranium industry. NRC mill tailings regulations and the

EPA's radiation dose standards have had, and will have, the significant effect of adding substantial costs to uranium production without the commensurate benefit of increased safety to the public.

- The NRC, the EPA, the DOE, the Department of State, and the Office of the U.S. Special Trade Representative, should jointly and frequently review federal policies and regulations which affect the viability of the domestic uranium industry (e.g., uranium mill licensing regulations, radiation dose standards, foreign uranium enrichment policy, export/import licenses, and international trade policies). This review should be undertaken with the purpose of establishing uniform federal uranium policies and regulations which ensure the maintenance of a viable domestic uranium industry.

- The DOE should undertake periodic reviews of the viability of the domestic uranium industry. It is suggested that at least every three years DOE thoroughly assess relevant issues affecting uranium industry viability.

AN AFFIRMATIVE OBLIGATION EXISTS FOR THE FEDERAL GOVERNMENT TO ACT NOW TO MAINTAIN A VIABLE DOMESTIC URANIUM INDUSTRY

The maintenance of a viable domestic uranium industry is essential to meet domestic energy needs. The Joint Committee on Atomic Energy recognized this fact in 1964 and amended the Atomic Energy Act of 1954 to require the maintenance of a viable domestic uranium industry. Section 161(v) of the Atomic Energy Act of 1954, as amended, provides:

> "...to the extent necessary to assure the maintenance of a viable domestic uranium industry," the Department of Energy "shall not offer (enrichment) services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States" (42 U.S.C.A., Sec. 2201(v), (1973), emphasis added).

An affirmative obligation exists for the Federal Government to maintain a viable domestic uranium industry. To the extent that a non-viable uranium industry exists in the U.S., the Federal Government must establish or amend existing policies to assure the existence of a viable U.S. uranium industry. Timely action by the Government will ensure the production of energy resources to meet U.S. energy needs. Without appropriate action taken by the Federal

Government, the U.S. uranium industry will continue to deteriorate and eventually fail to meet the necessary U.S. reactor fuel requirements.

Some may argue that it has never been clear exactly what a "viable" industry is in the United States. On a number of occasions, however, the Government has clearly stated key indicators of uranium industry viability. For example, in 1968, the Atomic Energy Commission (AEC) issued a statement on uranium supply policy in which it was stated that the price of uranium, the size of domestic ore reserves, the rate of development of new reserves, the probable penetration of the domestic market by foreign imports, and the size of the export market were important factors to consider when determining the viability of the domestic uranium industry. In 1971, the Atomic Energy Commission cited as justification for not removing import controls its

> "recognition of uranium production plans already adopted, the expected soft market over the next several years, the availability of large surplus domestic and foreign stocks, and the availability of excess foreign production capacity."

In addition, in 1974, Atomic Energy Commissioner William Anders testified before the Joint Committee on

Atomic Energy that:

> "These two factors, namely, the increased market and higher prices, point to uranium industry viability."

Sufficient guidelines exist, therefore, to indicate what is or is not a viable domestic uranium industry. To summarize, key viability indicators include: uranium demand, uranium supply (including exploration activities, inventories, reserves, production capability and costs), uranium prices, employment, productivity, capital investments, foreign uranium production capability and marketing efforts in the United States, and federal nuclear/uranium policies. In our opinion, the review of these key indicators by DOE, EIA, and the uranium industry indicates that the domestic uranium industry is not viable and that appropriate action is required by the Federal Government.

For example, uranium demand has decreased dramatically as projections for U.S. nuclear power development have been sharply reduced. Uranium-related employment has dropped as over 8,000 of the estimated 22,000 uranium industry workers have been laid off since January, 1980. Industry exploration activities have also declined significantly; if this trend continues, DOE projects domestic production shortfalls. In addition, uranium prices have dropped almost 60 percent since 1979. Finally, utility-held inventories have increased to more than 55,000 tons, which is forcing some utilities to sell excess amounts and thereby further driving down the spot market uranium price.

A detailed description of key viability indicators is included in the accompanying appendix.

PSYCHOLOGY OF THE MARKETPLACE

In any marketplace, many factors affect whether a consumer purchases one product over another. In all cases, of course, there is the threshold question of whether the product is actually needed by the consumer. In some cases, a major issue is price. Or, the decison is based on product availability or the fact that the consumer has confidence that a particular producer will supply the product on time and throughout the life of the contract. Still in others, the decision may be based on external pressures on the consumer requiring the purchase of a low-priced product regardless of security of supply or the long-term effects on the market. In most instances, all these factors combined help to formulate consumer decisions.

Most would agree that all these factors apply to the

U.S. uranium market. In the case of utility uranium procurement, reactor construction and operating schedules have a major influence on utility decision making. With the dramatic slowdown in U.S. nuclear power development, uranium requirements have dropped significantly from projections of the early 1970's. Nonetheless, uranium requirements are expected to almost double over the next nine years. Approximately 25 percent of the 26,000 tons of uranium projected to meet 1990 reactor requirements is presently under contract; the residual amount will be procured based on the abovementioned market factors.

It is these factors, viz. price, availability, security of supply, public utility commission pressures and federal nuclear/uranium policies which will determine whether domestic utilities procure domestic or foreign uranium.

Due to the unique federal control over the entire nuclear industry, federal policies have a major influence over U.S. uranium demand. This stems from enactment of the Atomic Energy Act which provides authority for the Government to regulate every aspect of U.S. nuclear development. While private sector uranium contracting does affect the viable condition of the industry, it must be viewed in the context of the tremendous influence federal nuclear and uranium policies have over the development of U.S. nuclear power and the resulting demand for uranium. The Federal

Government has an important if not critical role to play in revitalizing the U.S. uranium market. Without proper federal action, it is not safe to assume the uranium market alone will correct the current ills facing the industry. Under a decision of no government action, the domestic uranium industry will deteriorate further and eventually fail to produce U.S. fuel requirements. The DOE recognized this fact and stated in its July, 1981, report, "The Domestic Uranium Industry and Imports of Uranium," that, "if the level of activity continues to fall over the next few years, the exploration activity may not be adequate to assume that the U.S. would be able to meet long-term needs from domestic sources" (emphasis added).

The Government should immediately revise federal uranium regulations, require the principal use of domestic uranium to meet U.S. reactor requirements, and establish nuclear licensing and waste programs that promote the development of nuclear power. The Federal Government must address all of these policies; revising only federal policies concerning reactor development will be insufficient to rectify the problems facing the domestic uranium industry. Immediate Government consideration of all federal nuclear issues will help remove the uncertainty surrounding the future of the U.S. uranium and nuclear industries.

The Energy Department has recently reported that domestic utilities intend to procure no more than 30 or 40 percent of their total needs from foreign sources; this compares to the existing procurement of 10 percent of total needs from foreign sources. The question remains, however, whether the upper limit will in fact be maintained. There will always remain the possibility of utilities individually or as a whole becoming increasingly dependent on foreign uranium. According to DOE data, if all unfilled requirements through 1990 are supplied with foreign uranium, the U.S. will be 66 percent dependent on foreign supplies in that year.

The uncertainty created by the existing DOE policy permitting the increased use of foreign uranium in the United States has two negative effects on the uranium market. First, under the current policy and according to DOE, we can expect foreign uranium procurement to increase to at least 30 to 40 percent of annual domestic needs. This moves the U.S. into a vulnerable position resulting from potential supply disruptions. Second, by allowing increased domestic procurement of foreign uranium under the current policy, demand for domestic uranium will be even further reduced. The viability of the U.S. uranium industry can be partially reflected by the level of contracting activity in the domestic marketplace. Contracting is a highly diagnostic feature of uranium industry viability and is in many instances a prerequisite for a domestic producer to invest the necessary capital to develop uranium reserves. In order to assure a viable U.S. uranium industry, Government policies should have the effect of encouraging the principal use of domestic uranium; this can be done by amending U.S. enrichment criteria to require procurement of domestic resources.

As previously mentioned, due to strategic and economic concerns, the Federal Government has exerted tremendous control over U.S. nuclear power development. Through revision of the policies mentioned in my testimony, the Federal Government can and will stimulate contracting for domestic uranium and thereby ensure the viability of the domestic uranium industry. In addition, by taking this action, the Government will preclude an unnecessary dependence on foreign energy supplies.

Thank you.

Senator **Domenici**. What is going to happen if we don't have a Department of Energy? Will you have to revise your statement?

Mr. **Gibbs**. We will have to find someone else, I guess, to monitor.

Senator **Domenici**. We don't want to say DOE or some Government entity equally as diligent—that would be a bad way to say it, wouldn't it?

Mr. **Gibbs**. No.

Senator **Domenici**. Thank you very much.

Mr. Stevens, president, Kerr-McGee Nuclear Corp., will be our last witness.

STATEMENT OF BILL STEVENS, PRESIDENT, KERR-McGEE CORP., ACCOMPANIED BY RALPH LUKE, VICE PRESIDENT OF MARKETING AND MANUFACTURING

Mr. **Stevens**. Mr. Chairman, my name is Bill Stevens. I am president of Kerr-McGee Nuclear Corp. With me is Ralph Luke, vice president in charge of marketing and manufacturing.

Kerr-McGee has participated in all phases of the domestic uranium production since its beginnings some 30 years ago. We were a substantial supplier to the Atomic Energy Commission during the 1950's and 1960's. Our company is the largest producer or uranium within the United States. We have recently placed our Wyoming mines on standby, so Kerr-McGee's present production of uranium is entirely from the Grants and Gallup areas of New Mexico.

We feel that there is a close parallel between the circumstances that caused our present overreliance on oil imports and the developing pattern in the uranium industry. In my opinion, the situation with uranium could in the long term be as crucial to national security as the oil import problem since uranium is both an increasingly important energy fuel and an essential raw material in our Nation's defense program. We appreciate this committee's concern about the problems facing our young industry at this very initial state of its development. It is our privilege to share some of our concerns with the subcommittee today.

Briefly looking back at our history with oil, the United States pursued a course of increased reliance on low cost imported petroleum during the 1950's and 1960's. As oil imports increased, domestic oil exploration was dramatically curtailed. By 1970, the number of exploratory wells drilled was less than half of the 1955 peak in oil and gas exploratory activity. Because of the decline in exploratory activity. Because of the decline in exploration, domestic crude oil production capability began to decline as reserves were depleted. During the Suez crisis of 1967 it became clear that excess domestic oil production capability would no longer be available in the event of emergency. Domestic oil production peaked in 1971 and petroleum imports began to increase dramatically. In 2 years, 1972 and 1973, petroleum imports increased by 60 percent.

In November 1973, the United States was denied the right to purchase Arab oil. During the ensuing 1974 energy crisis, the consequences of our Nation's dependence on oil imports and our inability to compensate in a reasonable timeframe became all to obvious. What had appeared to be low-cost foreign oil turned out to be a very expensive and insecure energy supply for the Nation.

In retrospect, it is clear that more carefully formulated petroleum import policies during the 1950's and 1960's, with greater concern for domestic energy development, could have prevented the present problem with oil imports.

The question for us is, will we make the same mistake with uranium? There is an alarming similarity between the path that led to dependence on oil imports and the path we are now following with uranium.

I would like to talk about three subjects concerning the domestic uranium industry: first, the severe economic distress now present in the industry and its long-term debilitating impact; second, the problem of continuing Government uranium stockpile sales during a period of industry collapse; and third, the immediate need for reinstatement of uranium import restrictions.

The report titled "The Domestic Uranium Industry and Imports of Uranium" submitted to this committee by the Department of Energy, dated February 23, 1981, does not accurately reflect the present critical and worsening condition of the U.S. uranium industry. Uranium exploration is at a 10-year low in this country. The number of uranium drilling rigs active in New Mexico and Wyoming declined from over 150 in April of 1978 to 30 in April of 1981. Some drilling continues in order to preserve existing projects, but large blocks of uranium claims and leases are now being abandoned.

Uranium ore reserves are now at the lowest level since the early 1950's. Reserves must be distinguished from resources. The term "resources" generally refers to all known mineralized deposits where "reserves", by definition, are those resources which can be economically produced. In our judgment, very little of the U.S. uranium resource base can be economically produced at current market prices.

Senator **Domenici**. You know, Mr. Stevens, you and the people in mineral and energy development have waited a long time for people like me to get educated. I first sat on this committee over there by Senator Bartlet, and you remember he was not only a petroleum engineer but knew the economics of energy quite well. We were working after the embargo and before the Iranian crisis on all these regulatory bills. Would you believe that I didn't understand how reserves were related to prices. He kept telling me that, and I believed all the propaganda saying that isn't true, they are not related, raising the prices is gouging people. It took me about 2 years to understand it, so never assume that any of us really understand things even as basic as that. This is absolutely so, it happened to me. So you know what I knew. I had never traveled outside of Albuquerque, N. Mex., and didn't know anything about the energy field. So you and the New Mexicans took a whopping chance sending me up here.

Mr. **Stevens**. That is true, Senator, but we have been happy since then.

Senator **Domenici**. You didn't have to be so forthright.

Mr. **Stevens**. We have big things in the wind, though, Senator.

Senator **Domenici**. Go ahead.

Mr. **Stevens**. Uranium production is declining rapidly. New announcements of mine and mill closings are made weekly. In New

Mexico and Wyoming, the number within the uranium industry who have lost jobs now approaches the number employed. In addition, the local economic impact has been severe.

Relative to the costs of production, uranium market prices are at an all time low. Current production is only sustained by term contracts, but these conditions are also changing in a way leading to further mine closings. Some producers are buying uranium in the spot market to meet commitments and other contracts are being terminated. The June 1981 DOE uranium market survey shows a reduction in domestic contract commitments through 1990 of over 50 million pounds of U_3O_8 from the prior year's survey.

The U.S. uranium resource base is sufficient to meet domestic needs, but not at present severely depressed prices. A lead time of several years will be required to rehabilitate closed operations where possible and 10 years or more will be needed to find and develop new sources of supply.

Regarding the Government stockpile issue, Senator, the period 1972 through 1974 was a peak time for nuclear plant orders. At this time future U.S. uranium demand was estimated to be three or four times today's projection. During this period, the Atomic Energy Commission decided to reduce the Government-owned uranium stockpile and to eliminate restrictions on uranium imports.

On three occasions in 1974, Mr. D. A. McGee, chairman of Kerr-McGee, testified before the Joint Committee on Atomic Energy stating why our company felt these policy changes were premature. We have not changed our position on these important issues.

We believe, based on the best information available to Kerr-McGee, that during the Government fiscal years 1974 through 1980, the Atomic Energy Commission, or ERDA, or DOE has sold about 35 million pounds of uranium from the Government stockpile and that additional sales of approximately 12 million pounds of uranium are currently being made or are planned. These sales have been made through a rather complicated uranium enrichment policy known as split tails wherein the Government charges its customers for more enrichment services than it actually performs, but supplements from the stockpile the natural uranium supplied by the enrichment customer. Because this procedure is somewhat difficult to explain, and because detailed information on the split tails transactions are not readily available, Kerr-McGee recently commissioned a constulting report on this subject. Mr. H. A. McAlduff, a retired Chief of the Department of Energy toll-enrichment branch, was a principal contributor to the report. A copy of the McAlduff report [1] describing the split tails program has been provided to the committee staff and a summary of the report is submitted as a supplement to this statement.

Due to the depressed state of the uranium industry, and in the interest of national security, we believe that all stockpile sales from the Government's natural and enriched uranium inventories should cease.

Also, there have been recent press reports to the effect that the country may face a future shortage of nuclear weapons materials. If this is a possibility, it seems timely that the Department of

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[1] See the appendix.

Energy and appropriate congressional committees review U.S. uranium stockpile policies.

In concern with uranium imports, the AEC's 1974 decision to remove uranium import restrictions beginning in 1977 was based on nuclear power growth and uranium demand forecasts far in excess of actual developments. It is obvious now that the 1974 program was premature, based on erroneous assumptions, and did not anticipate the severe licensing delays affecting the nuclear industry.

As pointed out in the February 1981, DOE study, foreign commitments at the beginning of the year were 13 percent of demand through 1985, and 4 percent of 1986–90 demand. This, of course, referring to domestic demand. However, in recent months the Westinghouse uranium settlements with foreign producers and new foreign contracts have added significantly to import commitments, while domestic commitments are being cancelled.

We believe that in order to make the domestic industry viable, a permanent import limitation of 20 percent would be required.

Based on the options analysis in its February report, the Department of Energy apparently believes that continued import controls will injure the Government's enrichment contracting business. The United States has lost a large number of enrichment contracts to the Soviet and European enrichment plants in recent years. As a consequence, U.S. utilities must bear a larger share of fixed costs as the gaseous diffusion plants operate at reduced capacity. Nevertheless, the U.S. enrichment plants are cost competitive and this Nation is, or should be, the world's most responsible supplier. The real threat to our enrichment business comes from an overreliance on imported uranium that will eventually be enriched before reaching the U.S. market.

Because of the current distressed circumstances of the domestic uranium industry, Department of Energy programs related to stockpile liquidation and the enrichment of imported uranium for domestic use should be suspended and held in abeyance while new Government policies are formulated. Indeed, it would be disheartening to discover that the Department of Energy, while spending billions of tax dollars to fill a strategic oil reserved from costly imports, has liquidated a uranium stockpile of strategic importance and set the stage for uranium import dependence in the future.

Further, Kerr-McGee strongly endorses the call for general nuclear industry regulatory and licensing reform which has already been plentifully discussed. We hope for an early statement of nuclear industry support and vote of confidence by the administration and the Congress.

Thank you for this opportunity to outline our views. I would be pleased to respond to any questions or requests for additional information.

[The supplemental statement of Mr. Stevens follows:]

Supplement to the Testimony of Bill Stevens
Before The
Subcommittee on Energy Research and Development
Of The
United States Senate Committee on Energy and Natural Resources
At Hearings on
The Status of the Domestic Uranium Industry
and the Effects of Foreign Imports on Its Visability

"The Uranium Stockpile and Enrichment"Split Tails"

Summary

The history and origins of the government-owned "stockpile" of uranium inventory and the evolution and status of the mechanism by which it has been, and continues to be, disposed of - the "split tails" operation of the enrichment complex - is a technically oriented subject. A complete review of the details and facts surrounding this issue cannot be presented during the limited time available at these hearings. Therefore, Kerr-McGee submits this summary of the stockpile issue as a supplement to oral testimony and requests its inclusion in the record. In addition to the information contained in this supplement, we are submitting for subsequent review of the committee staff a report entitled, "U. S. Government Enrichment Operations - The Split Tails Concept", dated August, 1981. This report was prepared for Kerr-McGee Nuclear Corporation by the Nuclear Resources International Company of Atlanta, Georgia, and is presented as an objective and factual account of this history and current status of government operations relative to the stockpile.

It should be recognized that the uranium stockpile, as we speak of it, may currently be distributed in various chemical forms and enrichments. The commonly used unit of measure in the mining and milling industry is pounds of U_3O_8 and all values presented here will be on the basis of equivalent pounds of U_3O_8 of natural enrichment.

The domestic uranium mining and milling industry originated as a supplier to the government of a strategic material, the purchase and ownership of which was limited by law to the government. Following government and industry-sponsored demonstration projects, in which government-supplied enriched uranium was utilized to prove the feasibility of commercial nuclear power, the Congress, in 1964, passed the "Private Ownership of Special Nuclear Materials Act." This was the enabling legislation which allowed the development of the commercial nuclear power industry and concomitantly,the commercial uranium mining and milling industry. Both the announced purposes of the legislation and the Act itself included the recognition of two somewhat dichotomous goals.

These were that although the financial responsibility for commercial reactor fuel should be assumed by the nuclear industry rather than continued as a function of the government, the government bore an interim responsibility to insure the continuance of a viable domestic uranium fuel industry.

At that time, partially as a result of completion of government U_3O_8 purchase contracts but primarily due to a reduction in military requirements, the government uranium inventories which were considered excess were estimated to be approximately 100 million pounds of U_3O_8. Recognizing that the disposition of such quantities into the commercial market would have a tremendously negative impact upon the developing mining and milling industry, a variety of suggestions for an appropriate method of stockpile disposal were introduced and reviewed beginning in 1966.

In 1968, the Atomic Energy Commission reaffirmed the government's commitment to preserve the viability of the mining and milling industry, and while unable to quantify or define viability, they did detail factors which would be considered in characterizing viability. These factors were:

- size of the domestic uranium market
- price of uranium at the time the restrictions were removed
- size of the domestic ore reserves
- rate of development of new reserves
- probable penetration of the domestic market by foreign imports
- size of the export market

The discussions begun in 1966 culminated in 1972 when the chairman of the Atomic Energy Commission, before the Joint Committee on

Atomic Energy, outlined the plan for disposal of the approximately 100 million pounds U_3O_8 government stockpile beginning in 1974, utilizing a procedure which came to be known as the "split tails" concept.

The enrichment process consists of upgrading the U_{235} content of uranium as it is found in nature to a level necessary to sustain a chain reaction in nuclear reactors. The process takes a feed stream of natural uranium (.711% U_{235}) and produces an upgraded product stream (normally 2 to 4% U_{235}) and a downgraded byproduct stream (normally .2 to .3% U_{235}) called "tails."

The feed, product, and tails streams are interrelated. Holding the amount of product constant, increasing the tails assay increases the amount of feed required because less enrichment (separative work) is used. Therefore by selecting the tails assay, the enricher effects the quantity of natural uranium feed needed to produce the enriched product. Contractually, the tails assay used to calculate the amount of feed to be supplied by the enrichment customer does not have to be the same tails assay at which the enrichment plant will operate. The contractual tails assay is known as the transaction tails assay and the actual tails assay utilized is known as the operational tails assay. When these two parameters are not equal, the condition is known as "split tails."

In application, this procedure results in:

1. The enrichment customers provide less natural UF_6 feed than is actually utilized to produce the enriched product with the difference being made up from the government-owned inventories.

2. The enrichment customer, by paying for separative work (S.W.U.) calculated under the transaction tails value, provides more enrichment dollars than are actually used in producing the product. This additional revenue is applied as a compensation for use of the government-owned uranium used to produce the enriched product.

The actual procedure involves, among other parameters, the difference in timing between the actual use of the inventories and the recognition of the additional revenue, and is far more complex than the simplistic example above. However, irregardless of the circuitous accounting path, it culminates with the enrichment customers purchasing needed uranium from the government inventories.[1]

Through this mechanism, the AEC and successor agencies placed, during the period 1972 through 1978, the equivalent of 46.4 million pounds of U_3O_8 into the enrichment process. Of this total, by the end of 1980, about 34.7 million pounds had been delivered to the commercial nuclear industry, and at the start of FY 1981, a balance of approximately 11.7 million pounds apparently remains committed to this supplemental feed category for entry into the industry in the future. In addition, there currently remains approximately 40.5 million pounds U_3O_8 equivalent in government inventories.

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[1] See attached example calculation

The 1972 decision to initiate the split tails program was based upon the then-current perceptions of the development of the commercial nuclear power industry. These projections have not been fulfilled and all of the factors previously mentioned as indicators of the viability of the mining and milling industry are at their lowest point since the inception of the program. Any continued dilution of the uranium market by the release of government-owned inventories places the uranium mining and milling industry in jeopardy and is counter to the stated objectives of the government.

Additionally, throughout the original discussions relative to disposition of the stockpile, consideration was given both by industry and government to the maintenance of some quantity of uranium in the stockpile as an assurance against disruption in the basic fuel supply. In view of the outlook at that time, no specific action was deemed necessary. At the current time, however, in view of the fragile state of the domestic industry, there exists the real possibility that the domestic nuclear program could reach a point of dependence on foreign sources of supply.

Based upon the recently published statements by government officials, it also appears there now exists some question as to the level of government inventory necessary to assure Defense Department requirements. Any review of adequate stockpile quantities should certainly include this primary consideration.

Sample Calculation
Supplemental Feed Price

Under the assumptions that the feed material price includes a UF_6 conversion component of \$1.15/lb. U (\$2.53/KgU) and Separative Work is priced at \$119.00/SWU (Requirements Contract price), the effective price that the enrichment customer pays for the supplemental feed necessary to produce a 3% enriched product may be calculated as follows:

SWU/Kg product required	0.25 w/o	3.811
SWU/Kg product required	0.20 w/o	4.306
Difference		0.495

Feed/Kg product required	0.25 w/o	5.965
Feed/Kg product required	0.20 w/o	5.479
Difference		0.486

$$\text{Effective price} = \text{Requirements price} \times \frac{\text{decrease in SWU}}{\text{increase in Feed}}$$

$$= \$119.00 \times \frac{0.495}{0.486} \quad = \$121.20/\text{KgU feed}$$

$$= \$45.64/\text{lb. } U_3O_8$$

Thus, the enrichment customer would effectively pay \$45.64/lb.U_3O_8 for the supplemental feed

Senator **Domenici**. Thank you very much. I really appreciate all three statements. I think they help us immensely, and there are some excellent ideas that we ought to pursue.

I know it is late and you have been here a long time, but let me take a few minutes to ask a few questions.

Mr. Stevens, you indicated in your prepared remarks that some facilities of Kerr-McGee's have been placed on standby basis.

Mr. **Stevens**. Yes.

Senator **Domenici**. Is that costly? Does it cost significant money to do that?

Mr. **Stevens**. Oh, yes. It is a matter of which is the less costly. Typically in a situation where the uranium market has been declining, unless you have commitments that force you to do so, you look for those operations that are your most expensive and either start cutting them back or closing them down. And if you do it in such a manner that some day you hope to reopen them, in order to possibly proceed, you are going to destroy the operation.

Senator **Domenici**. You spoke of foreign countries and enrichment. How likely is it that foreign countries would begin to sell enriched uranium and stop using U.S. facilities?

Mr. **Stevens**. I think it is simply a matter of their economics. There is a distinct effort by several foreign countries now to develop their own enrichment plants, which they, generally speaking, have not had, and when that day comes at hand, there is no reason for them to necessarily continue to do business with this country.

Senator **Domenici**. I hate to keep going back to this import situation, but it does seem to me from my work on the Budget Committee that we are always having to make projections. Then when we miss, as we almost always do, we have to take the consequences because we have higher deficits or whatever it is when we are off. In thinking about that and your statement about 1974 and the decision under the act which charged them with changing the import policy based upon viability, it appears to me that they had to be totally off on projections of the status of the industry as of today. I don't think there was anything around that would have indicated we would be in this bad a shape today when they decided we are now robust and strong and ready to go independent. In fact, didn't they project extreme good health when that decision was made?

Mr. **Stevens**. Oh, very definitely. One of the things that the uranium industry has been good at, Senator, is making bad forecasts, and there are a lot of reasons for this. At that time there was tremendous optimism that there was going to be all sorts of plants coming onstream, utilities building large plants to take care of increased requirement. And as a consequence, the people who were involved in the production of the raw materials looked ahead that that was a very good business and they invested in it and started up large operations, lot of which they were just getting them going because of the long lead time of 6 to 8 years, and the bottom dropped out. The surplus basically is there because of things intervening in the normal process.

The uranium business, frankly, is kind of unique, I believe, in that it is not typically a free enterprise-type business. We talk about free enterprise and imports and all those good things, and they are good, but the uranium industry has been one that has been consistently governed and controlled to a greater degree than anything else I think as far as our Government is concerned, and the involvement of the Government in future plans and future commitments, and it is an industry that doesn't know from one week to the next, including the utilities, in fact, what they can count on, because of the involvement of the Government. So I think you have to look at that as a unique feature, I believe, in all of these theories.

Senator DOMENICI. Mr. Gibbs, in your testimony you suggest that an import restriction of 20 percent of foreign uranium that a domestic utility company may enrich on an annual basis would be an appropriate level. How do you arrive at that figure?

Mr. GIBBS. Well, Senator, first of all, in his remarks this morning, Governor Herschler mentioned a figure of 5 percent. In retrospect maybe that one sounds a little better.

Seriously, our 20 percent would be that number that our studies show would still allow a significant quantity of foreign uranium to come in, which we think is prudent both for economic and international trade, but also the 20-percent limitation would be very, very important from a market standpoint in promoting contracting between the uranium producers and the utility buyers. This seems to be optimum from our studies and computer runouts, and would be a number that would reduce existing inventories, not extremely rapidly, but at a rate that would certainly keep the industry viable. It would also stimulate the price, which is going to be necessary to really trigger this contracting that we think is so imperative for us to have a viable industry.

VOICE. We came up with that particular number as a result of our own internal analyses of the market, also some regulatory policy analysis that we had undertaken for us, but most important, we used the Eureka computer model. It is extensively used by the utility industry to look at the markets. Based on all the information, the computer model came up with the number, 20 percent, that seems to indicate the effects Mr. Gibbs mentioned, the drawdown of the inventories and the price increase what is what would be needed to help stimulate the industry and revitalize it.

Senator DOMENICI. Mr. Gibbs, you also indicated that NRC and EPA should reopen rulemaking proceedings on regulations affecting the current status of the industry.

I am fully aware of one set of regulations that comes out of NRC, and that EPA hasn't done its work on those yet, both as to the active and inactive piles. We ought to be able to do something for the agreement States before that ominous deadline that they have out there. But aside from that—and that status, it appears to me to have very widespread support up here because it appears to be so arbitrary.

But the Government has a fantastic stake in that because nobody is addressing the inactive tailings sites, which we have, at least at the authorizing level, made a commitment to pay for. They way it has been handled, funding will come out of the military. I guess everybody assumes there is all the money in the world in the military budget. So it seems to me that the military and the armed services people here ought to have an interest, and I think they do.

Do you know whether anybody has addressed Vice President Bush's Regulatory Reform Group that the President set up with issues of that type relating to the nuclear industry?

Mr. GIBBS. I am not familiar with that.

VOICE. Senator, we spent some time a couple of months ago talking with the regulatory reform officials and they said they would take looking into this under advisement. When the President does make a nuclear policy statement he should address the viability of the nuclear industry, one of the policy objectives being to establish a task force to look at the existing uranium regulations from the EPA and NRC. To date we have not had a concrete response from the White House or other areas.

Senator DOMENICI. I don't have any firsthand information with reference to it, but I would suggest, that you get back to them on this issue. We are getting information that they are almost finished and there is nothing in their work on this issue. If nothing else, certain groups ought to take another look at the Federal Government's liability if they are going to do just that 21 or 23 inactive sites. That is going to be an enormous price. The first authorization to do that was $80 million for the country or——

Mr. STEVENS. Some of the estimates were estimated between one half million dollars to $1 million an acre. The cost would be to clean up the piles.

Senator DOMENICI. I thought the last estimate had gone up almost three fold.

Mr. STEVENS. That could well be.

Senator DOMENICI. $300 million was originally estimated, and it is now approaching $3 billion for the inactive sites. I don't think anybody up here is really expecting to pay that money.

Well, let me ask a couple more questions of any of you. Maybe Mr. Canfield can answer this question.

Is any foreign government subsidizing the production of uranium? I understand that is a tough question because many of the countries producing copper and other things are socialistic or are not capitalistic. We also talked about whether they are required to expend on environmental standards for their workers or for their general environment something proportionate to us, or are they being given some kind of a bonus by way of having too much less? Do we know anything about those two aspects of the foreign competitors?

Mr. STEVENS. I do not believe there are any generally spoken of incentives of that nature. I think the major advantage that these foreign countries have is in the type of deposits which they have, which are extremely high grade and very large, and this gives them the major advantage.

Senator DOMENICI. Let me follow up on that, Mr. Stevens. There is some general discussion here this afternoon about the Federal Government stockpiling in the past and maybe their inordinate management of the stockpiling. In particular, Kerr-McGee is talking about that this afternoon. I would suggest that we look into the adequacy of our stockpiles. But you appear to be adverse to stockpiling.

Mr. STEVENS. The Mining Congress is adverse as a group to stockpiling, and the reason for this is a general feeling that if you develop a stockpile which is not required for some strategic purpose, the Government may decide at some time in the future to dump that stockpile, such as is now happening in the case of silver, and it really is of great concern to the markets to have an overhang of material which could suddenly be dropped on the market. I think that is the major consideration that most members would have. If it is strategic, that is one thing. If it is just a method for, in effect, subsidizing the industry, it tends to come back and bite you.

Senator DOMENICI. But the concrete suggestion that the strategic stockpiling may not be adequately diagnosed and consenquently may be low is not inconsistent with you. It is very logical, it seems to me, that while we are building an SPO reserve, we ought not to be so dumb as to think we now have an adequate reserve. If it is purely strategic, or if there is a risk, I understand.

Mr. STEVENS. We would agree with that. I would question whether all the interested parties in the Government might have a chance to make their views known on that. Perhaps the Defense Department might take a different view than the Department of Energy.

Senator DOMENICI. My last question goes to all of you.

It appears that you are telling me that the analysis conducted by the Department of Energy through 1980, reported out in February, is wrong and inaccurate in both the analysis and the conclusion as to the status of the industry. Is that what you are saying to the committee? They may arrive at the same conclusion because it would appear to some of them that we have to have no industry left for them to find that we have a bad situation. So many things happened in a very short period of time after this analysis was made, and at least that negates significantly the propriety or accuracy of the report.

Mr. GIBBS. Senator, the figures that are presented in the report are accurate through 1980.

Senator DOMENICI. Yes.

Mr. GIBBS. Or through the period they cover. It does not reflect what has happened in 1981, which has been very significant. Rocky Mountain Energy strongly disagrees with conclusions of the report on imports. We agree that the current level of foreign imports are not a problem, but the problem is the threat—it is a real threat, because they are sitting out there trying to sell uranium right now—the threat of foreign producers picking up the material that is not contracted for from 1984 and beyond is the real problem. And even though this won't happen, say in 1984, the fact that it will happen in 1984 is going to keep that market and the whole industry depressed, even in its near term. So it is the conclusions of the report and some of the more recent information that we disagree with.

VOICE. If I can add to that notwithstanding the fact that the data within the report is stale at this point, looking at it even as 1980 data, it would indicate on its face that the industry is in very critical condition. The conclusions don't follow. In addition, it is interesting to look back at the analysis of 1973–74 that the Atomic Energy Commission presented and there was a forward looking, a very forward looking analysis as to what the condition of the industry was going to be and the outlook for nuclear power, and the policy decision in 1973 was based on forward analysis.

The analysis right now that we are looking at from DOE seems to be a historical analysis based on a future policy decision on an historical basis. If they would look into the future as many of us have, and look at the potential further reduction of nuclear power, there would have to be a different conclusion reached by D0E, I assume, if, in fact, they took a foward looking approach today as they did in 1073.

Senator **Domenici**. I understand that we asked Exxon Minerals to submit a statement for the record. They have a statement here and a letter from the vice president. We will make that part of the record.

[The letter and statement of Exxon follow:]

EXXON MINERALS COMPANY

1251 AVENUE OF THE AMERICAS, NEW YORK, N.Y. 10020

E. P. MORTIMER
Senior Vice-President

September 23, 1981

Honorable Pete V. Domenici
Chairman, Senate Energy and Natural Resources
Subcommittee on Energy Research and Development
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

I am pleased to have the opportunity to respond to your request for a statement from Exxon Minerals Company on the outlook for the United States uranium industry. The congressional attention directed at this issue is timely, and we are pleased to contribute to your subcommittee's investigation of the viability of the domestic uranium industry.

The attached statement for the record presents a brief analysis of the outlook for the U.S. uranium industry, followed by conclusions and recommendations. We would be pleased to respond to any questions you may have regarding this material and to work with you and your staff during your deliberations on this matter.

Very truly yours,

EPM:gg
Attachment

STATEMENT OF
EXXON MINERALS COMPANY
SUBMITTED TO
THE SENATE SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT

September 25, 1981

This statement on the uranium industry by Exxon Minerals Company, a division of Exxon Corporation, presents the views of Exxon Minerals Company and Exxon Nuclear Company. Exxon Minerals Company's uranium production activities currently are solely within the United States, where it operates mines in Wyoming and Texas. The Company is engaged in uranium exploration and holds undeveloped uranium reserves in the United States, Australia, Europe and Africa. Another Exxon affiliate, Imperial Oil Limited, is engaged in uranium exploration and holds uranium reserves in Canada. Exxon Nuclear is engaged in the worldwide marketing of uranium.

Exxon Minerals Company's purpose in providing this statement is to contribute to the Subcommittee's investigation of issues affecting the domestic uranium industry. The following discussion presents a brief analysis of the outlook for the uranium industry, followed by conclusions and recommendations.

Uranium Outlook for the United States

Exxon's most recently published energy outlook shows conventional nuclear generating capacity installed in the United States increasing from 54 GW_e in 1981 to 120 GW_e in 1990. This 1990 projection is down from the 147 GW_e level forecast in Exxon's previous outlook. For 2000, installed capacity of 181 GW_e is projected. Exxon's forecast of U.S. uranium demand, based on a reasonable set of assumptions about lead times, enrichment tails assays, burnup rates, and other factors, shows nuclear reactor fuel requirements growing from 30 million pounds of U_3O_8 in 1981 to 48 million pounds in 1990 and 74 million pounds in 2000. Development of an updated uranium outlook is in progress, and indications are that projections of U.S. generating capacity will again be marked down.

Current user inventories of uranium in the United States are in substantial surplus, exceeding 3 years of forward supply. This surplus has accumulated as a result of lower-than-expected demand growth, reflecting cancellations and a lack of new orders for reactors. To date, uranium imports have not been a factor in the buildup of surplus inventories. The average inventory level desired by users is thought to approximate 1-1/2 years of forward supply, and Exxon assumes that the U.S. user inventory level will approach this desired level over the next several years. This reduction in surplus inventories has the effect of a source of supply which reduces the demand on uranium producers.

The production capability of the U.S. uranium undustry substantially exceeds demand. In 1980, the industry produced over 43 million pounds, compared to domestic nuclear reactor requirements of 23 million pounds. Currently producing U.S. mines plus those recently producing and placed on standby status have the capability of meeting domestic uranium demand through the mid-1980's. Including potential capability from U.S. mines currently under development plus those formerly under development but now suspended, the domestic industry appears capable of meeting domestic uranium demand in the late 1980's without the need for initiating new projects.

In the longer term, the U.S. uranium resource base is adequate to supply domestic requirements through 2000 and beyond, if called upon to do so. However, real costs of production from current domestic reserves will increase significantly over time as successively lower quality ore bodies are developed and mined. The actual development of U.S. production capacity, as distinct from potential capability, will depend on market conditions.

Uranium Outlook Outside the United States

Outside the United States, Exxon projects growth in Free World nuclear generating capacity from 78 GW_e in 1981 to 201 GW_e in 1990 and 396 GW_e in 2000. Nuclear reactor fuel requirements outside the United States are projected to grow from 39 million pounds of U_3O_8 in 1981 to 82 million pounds in 1990 and 160 million pounds in 2000.

Uranium inventories outside the United States, which include security stockpiles for some countries, currently represent about 4-1/2 years of forward supply. It is assumed that forward supply outside the United States will decline to about 3-1/2 years in 1990 and to 2-1/2 to 3 years by 2000.

As is the case with the United States, a surplus of production capability over demand currently exists in the rest of the Free World. The surplus, currently on the order of 10 million pounds per year, could grow to 30-40 million pounds per year or more over non-U.S. demand in the second half of the 1980's. This uranium, much of which will be produced from new mining projects under development and planned in Australia and Canada, may be available for export to the United States.

Implications for the Domestic Uranium Industry

Exxon's outlook assumes the operation of a free market, in which there will be a strong tendency for the most cost-effective properties to be developed first. A number of uranium properties outside the United States, particularly certain deposits in Australia and Canada, have the potential to produce uranium at costs significantly lower than those of most U.S. properties. It is likely, in a free market, that these properties will be brought into production in preference to many U.S. candidates for development. A result of this process will be an industry capable of supplying uranium to utilities at the lowest possible cost with benefits to consumers of nuclear-generated electric power in the United States and other countries.

Imports are not now a significant factor in U.S. uranium supply, but could increase to half or more of U.S. uranium demand in 1990 depending on domestic utility policies regarding diversity of supply. Although the domestic uranium industry faces tough competition from foreign producers, the relatively cost-effective domestic properties, both existing and planned, should find it possible to compete in the uranium markets of the future. However, a number of properties with relatively high production costs may not prove to be economically viable. It is likely that some currently producing mines will shut down before their reserves are exhausted, and that some future projects that have been in producers' plans will not be developed for many years.

To maximize its competitiveness, the domestic uranium industry will need to put increasing emphasis on producing uranium at the lowest possible cost.

The improvement and application of newer production technologies such as solution mining will be important to the domestic industry, as will efforts to find and selectively develop relatively high-quality U.S. deposits.

Recomendations

Exxon Minerals Company believes that the best interests of the United States will be served by the domestic uranium industry operating within a free, competitive market. Restrictions on uranium imports, tariffs, subsidies, international buffer stock schemes, and other artificially imposed measures to encourage production from high-cost mines that are not otherwise competitive would unnecessarily penalize consumers of electricity and should not be implemented. If future import levels create serious concerns over the nation's security of supply, consideration should be given to the creation of a national security stockpile of uranium. In this regard, it should be noted that the Department of Energy currently holds inventories of over 100 million pounds. As mentioned above, the U.S. uranium resource base could, if necessary, supply all domestic requirements for many years. A security stockpile could be designed to tide the nation over in the event of a supply interruption, until the flow of imports is re-established or until the domestic industry gears up to supply the shortfall.

Within the framework of a free market, the most effective encouragement the Federal Government could give the domestic industry would be to take measures to allow the resumption of the normal growth of nuclear power generating capacity. A national policy recognizing nuclear power as an important source of the nation's future energy requirements should be adopted and clearly articulated. A near-term manifestation of this policy should be statutory and/or regulatory guidance that calls for a substantial reduction in nuclear power plant construction lead times via a streamlining of the licensing process. Also, steps should be taken to alleviate the regulatory uncertainties that are discouraging utilities from placing orders for nuclear plants. Finally, a critical assessment should be made of the regulations affecting uranium mining and milling with the expectation that unreasonable and excessive measures would be modified.

Exxon Minerals Company thanks the Subcommittee for this opportunity to present its views.

Senator DOMENICI. Did any of you have any further observations you want to make to the committee?

Mr. STEVENS. I might make one personal observation. The DOE in looking at past performance, I don't believe that anybody has mentioned that the two foreign countries that caused the most concern did not have available material in the past. Their mines were not available to contract material.

Senator DOMENICI. You better start that over, please.

Mr. STEVENS. In DOE's looking at the past I believe they have ignored, or at least have not stated, the fact that this very low cost uranium from Canada and from Australia has not been available. Those mines are just being developed now, so that looking at the past, they have completely missed the problem.

Senator DOMENICI. Let me ask one last question that comes to me here.

The Assistant Secretary of the Department of Energy gave some testimony here this morning. I thought his facts were probably right, but I seriously questioned in my own mind whether he was properly categorizing American utility companies and those that buy uranium when he said that he didn't think the import problem was so serious because American companies for some reason wanted to buy American uranium. Now, I don't know why I don't believe that, but that sounds really like something above and beyond the call of duty these days, even though we are going more patriotic. Am I wrong?

Mr. GIBBS. I might say that I don't think the American utilities are any different than you and I. They look at this sort of thing as a matter of dollars and cents, and dependability, and once the spread difference between the cost of foreign fuel and domestic fuel is sufficient to overcome these fears that they have, they are going to buy foreign or they are going to buy domestic, and it is a matter of good business judgment. They would like, I am sure, to continue with foreign production, but the degree they continue is based on the cost of doing that.

Mr. Luke has a comment.

Mr. LUKE. Senator, I believe everything has been covered. I think that the domestic utilities, in my judgment, do prefer domestic suppliers as long as the price is the same. I think they find it very difficult to justify to their own customers and to their commissioners anything different than that.

Senator DOMENICI. I am convinced that an awfully lot of wonderful Americans are driving around in Hondas that would rather drive around in a General Motors car. I am sure that many of them living down in Texas go to those ballgames and when they play those wonderful patriotic songs before those football games, I am sure that the people that get those patriotic goose bumps drive up in Hondas.

Would you all be in argeement with presenting the industry position to the Vice President's task force?

Mr. STEVENS. I believe the American Mining Congress has approached this regulatory reform group. I don't believe it has gone too far.

Senator DOMENICI. What would you think if we ask Dr. Gilman to arrange a meeting with them? We can set that up and have a few of you attend and bring them current as to the industry position on this issue. Maybe we could do that in our office. That might have a bit of impact, instead of hidden out in those second rate rooms that they have over there. That is the only reason there would be any impact, the difference in room. Why don't we do that?

Unless you have something further to add, all of these statements will be made a part of the record. I appreciate your patience and the excellent testimony.

[Whereupon, at 3:50 p.m., the hearing was adjourned.]

[Subsequent to the hearing the Edison Electric Institute and the Arizona Public Service Co. submitted the following:]

JOHN J. KEARNEY, Senior Vice President

The association of electric companies

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November 25, 1981

The Honorable Pete V. Domenici
Chairman
Subcommittee on Energy Research and Development
Committee on Energy and Natural Resources
United States Senate
S402 Capitol
Washington, D.C. 20510

Dear Mr. Chairman:

In response to your letter of November 2, 1981, please find enclosed the Edison Electric Institute statement regarding the effects of imports on the domestic uranium industry. We appreciate your courtesy in holding the hearing record open to allow us to submit this statement.

The Institute's statement expands on the basic position expressed in my letter of October 28, 1981. The statement also suggests several actions which might assist the domestic industry without having to resort to such an extreme as establishing increased restrictions on the importation of foreign-source uranium for domestic use.

The Institute looks forward to working with your Subcommittee in resolving those issues leading to a revitalization of the electric utility industry and the Nation's nuclear power program which, in turn, will help revive the uranium producing industry. We are available at your convenience to meet with you and your staff to discuss these issues.

Sincerely,

John J. Kearney

John J. Kearney

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Enclosure

STATEMENT OF
EDISON ELECTRIC INSTITUTE
ON
STATUS OF THE DOMESTIC URANIUM MINING AND MILLING INDUSTRY: THE EFFECTS OF IMPORTS

SUBMITTED FOR THE RECORD TO

SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

November 25, 1981
(Hearing held September 25, 1981)

The Edison Electric Institute is pleased to submit this statement on the status of the domestic uranium mining and milling industry. The Institute is the association of investor-owned electric utilities. Its members provide about 78 percent of the nation's electricity, serving over 67 million customers. A significant number of EEI members own operating reactors or have reactors under construction and, therefore, are deeply concerned with the condition of the uranium industry.

Presently, some 11 to 12 percent of our total national output of electricity comes from nuclear power. Today's nuclear generating capacity, approximately 57,000 MWe, exceeds the entire installed electric capacity as it existed in this country just 35 years ago. In addition to the 77 nuclear plants with operating licenses, 78 additional plants have construction permits from the NRC. When completed, these will add about 86,000 MWe of generating capacity, which will result in generation from nuclear of about 30 percent of the national total. Nuclear power already is providing over 50 percent of the electricity in some areas of the country. The reliance on nuclear power has provided major benefits to the customers of electric utilities in terms of lower costs of generation, diversity of fuel resources, and decreased reliance on imported foreign oil.

On October 8, 1981 President Reagan enunciated his policy on nuclear power by stating that it is "(o)ne of the best potential sources of new electric energy supplies in the coming decades...." The Institute supports the President's policy. We also recognize that a healthy domestic nuclear power program requires and will promote a strong domestic uranium production industry. At the present, neither the nuclear power industry nor the electric utility industry are healthy; a condition that is reflected in the currently depressed state of the uranium market. The Institute takes the position that a healthy domestic uranium industry will follow directly if the Nation takes steps to revitalize its electric utility industry. Steps should not be taken that would help the domestic uranium industry if they would be detrimental to the electric utility industry. To this end, the Institute opposes any alteration to the currently established schedule for removing uranium import restrictions and supports actions such as increasing the enriching tails assay and removing regulatory obstacles hampering both the electric utilities and the domestic uranium industry. Fundamentally, to revive the domestic uranium industry we must revive the electric utility industry.

History of Uranium Import Restrictions

The maintenance of a "viable" domestic uranium industry in the United States for the protection of the common defense and security has been an issue since the mid-1960s. In 1964, at a time when there was limited commercial demand, excess foreign supply, low uranium prices and forecasts for great future demand, Congress amended the Atomic Energy Act of 1954 to provide protection for the then fledgling uranium industry. Section 161v (42 USC 2201), added to the Act by Public Law 88-489, prohibited the Atomic Energy Commission from enriching foreign-source uranium for domestic use, as necessary to maintain a viable domestic uranium industry. The AEC was directed to establish criteria governing enrichment of such uranium. In 1966 the AEC published criteria specifically prohibiting enrichment of any foreign-source uranium intended for domestic use (31 FR 16479). After several years of receiving public comment on the matter, in 1973 the AEC proposed the criteria that are in effect today (38 FR 32595). After receiving public comment from 39 parties, including 15 uranium producers and 17 utilities, and after public hearings before the Joint Committee on Atomic Energy on September 17 and 18, 1974, the AEC adopted the criteria. These well known criteria withheld the use of foreign-source uranium in domestic reactors until 1977 and since then permitted a gradual increase in the amount of foreign-source uranium that may be enriched for any one domestic customer such that this year, 1981, the limit is 40%. The criteria provides for an increase in this limit to 60% in 1982, 80% in 1983 and 100%

in 1984 and thereafter. It is most interesting to note that in each of the four years since the start of the gradual removal of import restrictions, the aggregate amount of foreign-source uranium enriched for domestic use has always been less than one-half of the allowable percentage. In 1980, the actual usage of foreign-source uranium was 10% versus the 30% allowable.

On February 22, 1974, the Edison Electric Institute filed comments with the AEC regarding their proposed new foreign-source uranium enrichment criteria. On September 17, 1974, the Institute participated in the Joint Committee hearings. On those occasions, the Institute supported the AEC proposal partly on the basis of experiencing poor responses to utility requests for bids from domestic uranium producers and that "(t)he relaxation of the total prohibition on access to foreign uranium markets will allow utilities to carry out their nuclear power programs without resorting to the use of our highest cost domestic uranium resources and permit us to conserve a very valuable domestic resource". The Institute also suggested that the restrictions be removed more rapidly. The Institute concluded that the proposal "...will assist in assuring an adequate supply of uranium for the electric utility industry's nuclear power expansion program without detracting from the development of a viable domestic uranium mining industry". This position was supported by the electric utilities that filed statements with the AEC or the Joint Committee.

The Institute further studied the question of uranium supply in the March 1976 report NUCLEAR FUELS SUPPLY prepared in conjunction with the Tennessee Valley Authority, members of American

Public Power Association and The Enrichment and Reprocessing Group of Japan. This study was carried out because increasing reliance on nuclear power is dependent upon the timely resolution of a myriad of nuclear fuel cycle problems. One purpose of the report was to clarify issues and identify options for electric utilities in uranium supply. The report found (in 1976) that beyond 1985, uranium supplies could prove inadequate unless domestic exploration is accelerated and foreign supplies become more available. This finding led to a recommendation that "(u)tilities should take a position in favor of a free uranium market and urge that the government remove or further relax the current restrictions on import".

Current Situation

Since 1976, the growth of nuclear power has proven to be lower than previously projected, which is the major cause of the current depression in the uranium industry. Much uranium was purchased and then extensive slippages occurred in reactor completion schedules, resulting in the accumulation of large inventories of uranium and a low near-term unfilled demand.

Thus, the uranium industry has experienced severely cyclic market conditions. The spot market price rose from under $6/lb in 1972 to $43.25/lb in 1979 and has since fallen to $23.50/lb at present. The question at hand is: What, if anything, should the Federal Government do to provide greater stability and predictability to the industry?

At the hearing on September 25, 1981, some uranium producers indicated a strong feeling that the industry is not "viable" and that increased uranium import restrictions should be established. The hearing also brought out that this is not a consensus among the domestic uranium producers; some do not favor any change in the present schedule for relaxation of import restrictions. It should be noted that there are producers who are healthy, holding reserves, exploring and making further investments in the uranium production business. The DOE took the position that the current uranium market situation is caused by reactor delays and cancellations, and a lack of new orders. The DOE maintained that the current foreign-source uranium criteria have worked well and should remain in place.

Discussion of Institute Position

The Institute is anxious to have a vigorous and healthy domestic uranium production industry in place. Many utilities attach great importance to a security of supply that can only be offered by a domestic producer. Also, national security considerations dictate the need for a strong domestic uranium supply capability.

We are certainly sympathetic to the problems the mining industry is facing, but imposing more stringent import limitations is not the solution. The problems of the uranium production industry are largely due to the problems of the utility industry and taking actions that help the uranium producers and at the same time hurt the utilities is not a way to solve the basic problem. Solutions are needed that help both the uranium producers and the utilities.

Most projections show that an appreciable amount of uranium must yet be purchased or contracted to be delivered in the last half of the 1980's and beyond. Current projections indicate an annual domestic uranium demand of about 25,000 tons by the early 1990s. Therefore, there should be an increase in market activity well prior to that time. Even though some of the business may go overseas, there will be opportunity for the domestic producers to make substantial new sales.

The Institute strongly believes in the concept of free trade. Any extension of the limitations on the import of natural uranium would be in conflict with this principle. The imposition of any additional limitations on the import of uranium, insofar as they would inhibit expansion of the use of nuclear energy, would be inconsistent with the views expressed by the President. Import restrictions, which might benefit the uranium industry, would penalize the utility industry and the electric rate payers. Based on the schedule of relaxation of import restrictions, which has been in place since 1974, utility companies have been planning and executing uranium procurement programs consistent with this schedule. To make a change now would be disruptive and costly.

DOE Reports

The reports by the DOE Office of Uranium Resources and Enrichment ("The Domestic Uranium Industry and Imports of Uranium," dated February 23, 1981) and by the Energy Information Administration (EIA) ("The Impact of Various Federal Policies on the Uranium Market," draft dated September 1981), present considerable data on the current and projected uranium market and on the possible effects resulting from changes in the existing schedule for relaxing import limitations. We find both of these reports informative and useful, and we rely on these reports for certain aspects of this statement.

Basically, the EIA report concludes that any extension of the import restriction on natural uranium will result in an increase in the prices paid by utility companies for natural uranium and that this increase can be severe. EIA estimates typical average price increases in the 1990s of $15, $25 and $50/lb if the embargo limits are 40, 30 and 20%, respectively (EIA Report Figure 5.7). For an annual uranium demand of say 25,000 tons/year which is typical of the early 1990s, this equates to cost increase to utility companies of $750 million to $2.5 billion per year. Such cost increases would have to be borne by the consumer. While the magnitude of the increase in uranium prices due to increased import restrictions is uncertain and not subject to precise calculation, there is general agreement that any such actions will lead to some level of cost increase. The EIA study shows that even a voluntary restraint by the utility companies results in some increase in price.

Voluntary Restraint

In the interest of assuring a continued domestic uranium production capability, some level of price increase brought about through activities in a free uranium market may indeed be justified. However, we propose that this not be brought about by the Federal Government imposing further limitations on the importation of uranium.

Recent surveys of the utility industry by DOE have indicated that utilities in general do not wish to contract for more than 30-40% of their uranium needs from foreign sources. This is undoubtedly an oversimplification and the true percentage probably depends on a number of dynamic factors such as price differential, perceptions of the continued ready availability of uranium, the world political situation, and other less obvious factors. While the level of voluntary restraint may be uncertain and may change with time, it is fundamentally there. We believe this is an important consideration and will serve to prevent rapid increases in the extent to which uranium is imported.

In projecting future uranium import levels, two interrelated factors, the extent of the low cost foreign resources and the prices that foreign producers place on their sales, must be considered. Foreign producers will do what they can to avoid depressing the uranium price, including withholding material from the market. Obviously, the higher the price of the foreign material, the more competitive the domestic producers.

It is worth noting again that the limit of foreign-source uranium intended for domestic use in 1980 was 30% whereas actual deliveries of foreign-source uranium for enrichment were only 10%. In addition to the large amounts of domestic uranium held by utility companies, several currently hold a large proportion of foreign uranium. However, this is the direct result of unforeseen reactor construction schedule delays occurring after having contracted abroad for what was expected to have been a limited portion of future annual needs. Thus, we believe there will be a reasonable level of voluntary restraint shown by utilities.

Other Factors

Based on the EIA analysis, any increase in the limitation on the import of uranium will not result in a significant short term increase in the production of uranium from domestic sources, but it will increase the price. Therefore, this type of change is not particularly cost effective. Such a change would likely affect domestic production in the longer term (5 to 10 years and after), when we believe there will be a sufficient resurgence in uranium purchasing so as to provide domestic producers the opportunity to capture significant new sales commitments.

Domestic utility companies are not prohibited from using foreign enriched uranium. In the past, foreign enriching services were generally more costly than DOE services, but this is changing. Foreign suppliers are actively trying to sell enriched uranium and/or enriching services to U.S. utility companies. Since the limitation on the import of uranium is set forth in terms of limiting the use of DOE enriching services, the imposition of more stringent limits might encourage domestic utilities to contract for foreign enriching services. The Institute believes it would not be in the national interest to establish policies which as a side effect would encourage domestic utilities to go overseas for enriched uranium or enriching services.

The Institute feels that there should be a substantial domestic uranium production capability so that there is always the opportunity to purchase domestically. This in turn means that uranium producers must be able to be responsive to requests for proposals.

If the domestic industry shrinks to an inadequate production capability, then in the future the producers might not be able to respond to requests for proposals, as was experienced in the mid 1970s. This undesirable situation could lead to the further difficulties within the uranium industry.

Suggestions for Potential Actions

The following are some specific suggestions as to possible courses of action the government could take to help resolve the problems of the uranium industry:

Tails Assay

In the process of enriching uranium, a portion of the uranium delivered for enrichment is discarded in a "tails stream". The U235 concentration of this stream is referred to as the "tails assay". There is a trade-off between the relative amounts of uranium and enriching service needed to produce enriched uranium, the specific relationship being determined by the tails assay. A higher tails assay increases the uranium and reduces the enriching service needed to produce a given amount of enriched uranium.

A change which could be put in place by DOE (without the need for legislation) and would provide a quick increase in the uranium requirement, is an increase in the transaction tails assay. DOE can change the transaction tails assay on appropriate notice. The transaction tails assay can be increased to as much as 0.25% without introducing contractual problems to DOE. The current transaction tails assay is 0.20%. A change to 0.25% would increase uranium demand by about 9% as soon as the change is made, thus creating a substantial near-term increase in unfilled demand. The utility industry would probably be receptive, at this time, to considering possible increases in the transaction tails assay along with the availability of the variable tails assay option for requirements contracts. We are aware, however, that an increase in tails assay might cause some increase in the price charged for enriching services and therefore we would have to study details of any proposed tails assay change carefully before we could support this form of action. If the increase in the price of enriching services is relatively small, an increase in the tails assay might result in a lower total cost for enriched uranium. Due to changing market conditions the transactions tails assay should be subjected to periodic review.

Government Uranium Inventory

National security considerations dictate a need for a substantial domestic uranium production capability, or alternatively, the availability of extensive stocks of uranium from inventory. Otherwise, any future disruptions in deliveries of uranium could have a major adverse impact on the continued supply of electricity.

Perhaps the government should consider always carrying a uranium inventory, sufficient for several years demand coverage, as a strategic inventory for national security purposes. The current government inventory may be sufficient for this purpose, if it is not drawn down by the use of split tails operation. Any increases in such an inventory should be obtained from the market.

Environmental and Licensing Considerations

o Electric Utilities

The President has made it his policy to remove regulatory barriers to efficient business operations. The electric utilities are burdened with unnecessary regulation which is contributing to the currently poor condition of the electric utility industry. Relief from that burden will assist the recovery of our industry and, as we have said before, contribute to a strengthening of the domestic uranium industry.

o Uranium Industry

In the same vein, a regulatory barrier to the uranium industry involves recent efforts of the Environmental Protection Agency and the Nuclear Regulatory Commission with regard to uranium mills and mill tailings. The uranium producers have stated that the EPA and NRC seek to impose regulatory requirements regarding radon release at unnecessary and scientifically unsupportable levels, which will result in excessive costs. The September 25, 1981 statement of the American Mining Congress addresses this point at length and places it first in order of importance in their request for removal of barriers inhibiting the growth of the domestic uranium industry. The Institute agrees that lessening of unnecessary and overimposing government regulations would provide relief for the domestic uranium industry.

Closing

The Institute appreciates the opportunity to present these views and looks forward to working with the Subcommittee to resolve the problems facing the entire nuclear industry. It is absolutely vital that the electric utilities and the nuclear industry, including the uranium producers, regain their lost vitality. It is only then that the President's goal of a rejuvenated nuclear option can be realized and the citizens of this Nation can reap the benefits of nuclear energy. However, it is not in the best interests of the Nation to impose new regulations further limiting the import of uranium.

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ARIZONA PUBLIC SERVICE COMPANY
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RUSSELL D. HULSE
VICE PRESIDENT

December 4, 1981

The Honorable Peter V. Domenici
Chairman
Subcommittee on Energy Research
  and Development
Committee on Energy and
  Natural Resources
United States Senate
S402 Capitol
Washington, D.C.   20510

RE: The State of the Domestic Uranium Industry

Dear Mr. Chairman:

Arizona Public Service Company (hereinafter referred to as "APS" or the "Company") appreciates this opportunity to submit for your consideration its views with respect to your subcommittee's inquiry into the current status and future of the domestic uranium mining and milling industry as well as the subject of limitations on the importation of foreign source uranium.

APS is an investor-owned utility engaged in the generation, transmission and distribution of electrical energy to over 400,000 customers within a 50,000 square-mile area of the state of Arizona. Although a substantial portion of electricity generated by the Company is currently derived from coal-fired generating facilities, a growing percentage will be generated from nuclear energy when, beginning in 1983, 1984 and 1986, the three units of the Palo Verde Nuclear Generating Station (each rated at 1270 megawatts) commence commercial operation. Palo Verde, located approximately 50 miles west of Phoenix is a joint venture between the Company and utilities serving in California, New Mexico and West Texas. APS is both project manager and operating agent for the facility. Because of its involvement in this project, the Company is vitally concerned with the availability of both domestic and foreign sources of uranium.

Our nation has recently learned an invaluable lesson from its overreliance on foreign oil sources. As a consequence, it has become a national goal to conserve our energy resources through wiser, reduced use and development of other energy alternatives. Our government has stressed greater development of coal, along with nuclear power, solar and other renewable resources in order to avoid a recurrence of artificially induced shortages and inflationary price increases which can result from the whims of foreign governments. Within this scenario, electric utilities have walked a tightrope between secure, feasible fuel supply sources on the one hand, and the most reasonable prices available for those resources on the other, a position which oftentimes results in dilemma; for under current circumstances, the most reasonably priced resources available are foreign derived, which at the same time are not the most desirable sources, given our recent experiences with Middle Eastern oil.

Where uranium is concerned, we then are compelled to ask, what is being done to keep history from repeating itself?

It is obviously in our nation's best interest to maintain a stable, healthy domestic uranium industry. As you have pointed out on occasion, the law of the land directs the Federal government to promote this end. How to attain that goal is as formidable a dilemma as is that faced by the utility industry in its quest for secure yet reasonably priced uranium supplies.

It has been said that the current predicament of the domestic uranium mining and milling industry stems from the current economic problems confronting the nation as a whole, and the limitations on development of nuclear generating capacity in particular. We have faith that we will see an upturn in both the country's economic growth and the expansion of nuclear electric generation; but, when this upturn occurs, will the domestic uranium industry be capable of responding? What is being done to assure that it can meet the demand for uranium when called upon to do so? That industry must be encouraged to take steps now in preparation for the upturn, not years from now, when increased demand is upon us and supplies are then so limited that prices reach unreasonably high levels.

This all is reducible to a question of planning. As a public utility, APS is obliged to provide electric service to its customers at the lowest practical cost. To discharge this responsibility, it must continually review and update its plans, including those dealing with fuels acquisition. This planning takes into account long-term sources as well as short and mid-term effects. Today, our projections tell us that the most economical short-term and mid-term uranium sources are located outside the United States, a fact which could lead us on the continuing path of energy dependence on foreign sources.

The fact that short and mid-term foreign sources are the most economical presupposes that the world will adhere to free market conditions. It did not in the case of oil; and although the players in the foreign uranium market are different, there can be no assurances that natural conditions will be allowed to operate freely here, either. In plain fact, the rest of the world subscribes to a slightly different concept of the free market than does this country, and, this being so, it is of considerable concern to many utilities that there may be some future attempt at manipulation to drive the domestic industry down to a minimum. At the same time the utility industry's reliance on foreign sources will increase, creating an open invitation to foreign producers to raise prices. By that time we utilities will have no alternative but to pay the price.

One readily apparent solution to the problem posed by this scenario is an embargo of foreign source product. Some have suggested that it be self-imposed by the utilities and not implemented by the government. To a limited degree, this has been done in the past and will continue into the future. But there is a limit upon the ability of utilities to sustain self-imposed restrictions. Stringent regulatory control and financial stress may compel utilities to seek a greater percentage of foreign source material than they might otherwise care to. In fact, there are two apparent reasons why we have not yet seen this shift: inter-utility and utility-domestic supplier inventory transactions that have come about because of delays or cancellations of generating units, and limited utility owned and operated uranium resources.

Yet another concern to utilities is the ever-changing regulatory climate controlling the development of nuclear powered generation. Drastic policy shifts and changing regulatory requirements adversely impact upon utilities' ability to plan. Business must change and with it, governmental regulatory requirements; however, no changes can be imposed absolutely -- there must be some protection for those irreversibly committed to a predetermined goal through financial investment and effort.

With those concerns in mind, APS proposes the following as a means of preserving domestic production capabilities, while at the same time affording the electric utility industry the opportunity to procure for its consumers the benefit of reasonably priced uranium:

1. Maintain the current uranium import restriction at its 1981 level of 40% for a five-year period, subject to congressional review at the end of three years;

2. Grandfather any foreign source purchase contracts entered into prior to December 31, 1981, in anticipation of the current embargo phase-out remaining in effect;

3. Reduce domestic mining costs (and hence increase the ability of the industry to compete) by requiring a review of uranium reclamation and disposal requirements for mines and mills, making certain that only those cost-effective requirements dealing with health and safety are retained; and

4. Stabilize and strengthen the utilities' demand for uranium by requiring a similar review of all regulatory and permitting requirements for the construction and operation of nuclear power plants, leaving in place only those which are cost effective and protective of bona fide concerns.

As great as our concern that the integrity and vitality of our domestic uranium mining and milling industry be preserved is our desire that another domestic resource -- uranium itself -- not be squandered on ineffective, short-term measures. Some have suggested that as a cure for the domestic doldrums, the split tails and the transactional tales could be manipulated to provide a new short-term market for domestic production. We view this as a possible waste of a valuable, nonrenewable mineral asset. We urge that the Department of Energy be prevailed upon not to move quickly into a short-term remedy of questionable effectiveness which will certainly impact this country in the long run in terms of material waste or higher recovery cost. At the same time, the Company recommends continued review and development of reprocessing of spent fuel, with the goal of reducing uranium oxide requirements from the mining and milling industry. We must take all measures calculated to maximize the use of our domestic energy resources.

APS supports the free enterprise system, free trade and efficient utilization of our energy resources. One of the most effective ways to attain all three goals is the promotion and preservation of a viable domestic mining and milling industry, able to

The Honorable Peter V. Domenici
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responsively compete with foreign sources without the aid of complete embargoes or other governmental manipulations. Stringent government controls can only serve to upset efficiencies which can be attained by natural market forces to the ultimate detriment of the consuming public.

The Company trusts that its observations will be of some assistance to you and other members of your subcommittee. We again wish to express to you our appreciation for the opportunity to offer these comments. Should you or a member of your staff wish to pursue any of our recommendations with us in more detail, please do not hesitate to contact me.

Very truly yours,

Russell D. Hulse

RDHULSE:b

APPENDIX

REPORTS SUBMITTED FOR THE RECORD

Energy Information Administration

WORKING DRAFT

THE IMPACT OF VARIOUS FEDERAL POLICIES ON THE URANIUM MARKET

September 1981

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WORKING DRAFT

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PREFACE

This document reports analyses of the domestic uranium market, under various policy alternatives. The analysis was requested by Senator Pete V. Domenici, Chairman of the Senate Subcommittee on Energy Research and Development. The analysis was conducted by R. Gene Clark, Diane L. Jackson, and Zdenek D. Nikodem of the Nuclear and Alternate Fuels Division, U.S. Energy Information Administration. For further information, contact R. Gene Clark, Acting Director, Nuclear and Alternate Fuels Division, at (202) 633-8521.

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EXECUTIVE SUMMARY

The recent decline of the "spot-market" price of uranium and the potential for development of relatively low-cost foreign supplies have rekindled Congressional concern about the viability of the domestic uranium supply industry. At the request of Senator Pete V. Domenici, Chairman of the Senate Subcommittee on Energy Research and Development, the Office of Uranium Resources and Enrichment (U.S. Department of Energy) prepared a report on the uranium industry and imports. The report concludes that the current policy of gradually reducing the restriction on enriching imported uranium is justified because the industry is currently viable and not threatened by potential imports.

The Department of Energy study, although endorsing its current policy, does identify six other policy options that could be implemented if deemed necessary to protect the domestic industry. Senator Domenici subsequently asked the Energy Information Administration to estimate the future impacts of these policy alternatives on the uranium market, as a supplement to the earlier study.

This document reports the results of analyses of the uranium market under current policy and six other alternatives:

1. Current Policy -- From the current upper limit of 40 percent imported fraction of uranium delivered by each domestic enrichment customer, increase the maximum fraction to 60 percent in 1982, 80 percent in 1983, and no limit thereafter;

2. Deferred Embargo Removal -- Return to the maximum import fraction of 30 percent in 1982 through 1986, with annual successive limits of 40, 60, and 80 percent followed by no import limits after 1989;

3. Import Ceilings -- Beginning in 1982, alternative limits of 20, 30, or 40 percent imports at least through the year 2000;

4. Tariff on Imports -- Imposition of an import tariff to offset potential cost differences between foreign and domestic production;

5. Modified Enrichment Transactions Policy -- Increasing the demand for uranium by modifying the terms under which enrichment services are provided;

6. International Commodity Agreement -- Implementation of a buffer stock scheme designed to stabilize

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prices; and

7. Federal Stockpiling -- Increasing Government stocks of uranium in order to support prices.

The central focus of concern in the request for this analysis is the viability of the domestic uranium producing industry. Furthermore, there is a statutory basis for Federal action whenever such viability is threatened. Section 161v of the Atomic Energy Act of 1954, as amended (Public Law 88-489), provides the authority for the Federal Government to limit its enriching of foreign-origin uranium (intended for domestic use) "to the extent necessary to assure the maintenance of a viable domestic (uranium) industry." Such legislation resulted in a total embargo on the enriching of imported uranium for domestic use during the period 1968-1976.

There are several issues which complicate the implementation of this responsibility. First and foremost is that legislative history provides scant guidance as to how the industry's "viability" is to be determined. It is relatively straightforward to determine whether a particular corporate entity is viable, but it is not so straightforward to define or measure the viability of an entire industry. This determination has essentially developed into a "judgment call," based on the Department of Energy's consideration of multiple indicators of the industry's activity level in such areas as production, employment, investment, etc.

In 1968, for example, the Atomic Energy Commission (AEC) issued a statement on uranium supply policy in which it was stated that the price of uranium, the size of domestic ore reserves, the rate of development of new reserves, the probable penetration of the domestic market by foreign imports, and the size of the export market were important factors to consider when determining the viability of the domestic uranium industry. The AEC stated its justification in 1971 for not removing import controls as being "recognition of uranium production plans already adopted, the expected soft uranium market over the next several years, the availability of large surplus domestic and foreign stocks, and the availability of excess foreign production capacity." Finally, in 1974, the AEC added national self-sufficiency in energy supplies to the list of important factors.

Another key issue in the area of viability is that it is not clear what responsibility vs. what means the Federal Government has to protect the industry when its viability is threatened by factors other than imports. Clearly several of the policy

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options, requested to be analyzed, deal with this issue.

In the course of this analysis, it became evident that the domestic uranium industry is not in a healthy condition. The current (August 1, 1981) "spot market" price of $23.50 per pound of uranium oxide is below the estimated operating cost of about 90 percent of domestic production capacity. However, by virtue of the large volume of contracts (with imbedded price limits) signed before 1981, the average price for deliveries made in 1981 is expected to be somewhat in excess of $30 per pound.

If the industry were to grow over the next few years, we estimate that about 1,500 annual tons of additional production could be developed at a break-even cost (not including profit) of $30 per pound. At a production cost of $40 per pound, an additional 15,500 tons of annual production could be brought forth. A caveat should be repeated -- these are "break-even" costs, and prices at these levels would not induce the investment required to bring the reserves into production.

In looking to the future, the information considered here points to two critical time frames for the domestic uranium industry. Because of current oversupply, the industry is expected to diminish significantly over the next 6-8 years -- a period to be characterized by a sparse market demand and the pressure of excess consumer inventories. In this period, imports per se are expected to be an insignificant source of supply to domestic consumers.

On the other hand, competition from imports is potentially the most significant market factor facing the domestic uranium industry by the end of this decade. If foreign producer competition and development of foreign production sources are vigorous and if domestic consumers relax their cautious attitude about reliance on foreign supply the domestic uranium industry could be reduced to less than 5 thousand tons of production annually -- less than a quarter of its present size. At this size, it would supply about 20 percent of domestic consumption and would probably not be deemed "viable" by any standards.

By the turn of the century, if foreign and domestic demand increase and some of the low-cost foreign resources are depleted, the domestic industry could increase to a size of about 10 thousand tons of annual production, which would supply about a third of dometic needs.

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The conditions outlined in the previous paragraphs are premised on current-policy and perfect-competition conditions. A moderating influence might be the domestic utilities' diversification of their supply sources to enhance their assurance of obtaining uranium. As a group, domestic utilities have expressed a desired upper limit of about 35 percent on the portion of their supplies from foreign sources. This limit is not a static figure but could quite possibly change as market conditions evolve. For example, if significant price differences, develop between foreign and domestic supplies or if domestic utility concerns about security of supplies abate, this limit would undoubtedly change (probably to a higher percentage).

Because of their projected production cost advantage over domestic producers, some foreign producers could choose to withhold production and let a domestic high-cost producer determine the marginal price. Through the "market price" contract mechanism, this marginal price would set the value for settled price in many other supply arrangements. This would result from the formation of a cartel or other joint profit-maximizing arrangement.

On the other hand, under highly competitive conditions, the self-imposed 35-percent import fraction could affect a price differential of a much as $20 per pound between domestic and foreign suppliers -- a differential which might be hard to justify to public utility commissions. With this in mind, utilities might choose to diversify their supply sources among several foreign suppliers, rather than between domestic and foreign sources.

At any rate, the long-term viability of the domestic uranium industry may come to rely heavily on restraint by foreign producers, who (as a group) could develop supplies at significantly lower cost.

Turning our attention to the impacts of the various policy options, several of the options can be dismissed as not being feasible contenders. The "Deferred Embargo Removal," under which a 30-percent limit on imports is maintained and then gradually released, clearly does not have the effect desired. It protects the domestic industry from imports only over a period of time in which imports would be small anyhow. If lifted after 5 years, it removes protection from the industry precisely when it would potentially be needed.

Similarly, the "International Commodity Agreement" option, if

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implemented in a way to support the domestic industry, could require stockpile purchases in excess of 20 thousand tons of foreign uranium at a cost of more than $2 billion anually during some periods. Furthermore, there would likely never be the opportunity to liquidate the stockpile as intended.

The other four alternatives to the present policy are more direct in their consequence. Their estimated impacts follow.

Import Ceilings

Three levels of control are considered: 20, 30, and 40 percent of domestic uranium requirements. In none is there a significant change in domestic production or net imports over the next 5 years. On the other hand, the market price could be affected noticeably and as early as 1984. This early effect follows from the removal of part of the lower-cost foreign supply from the long-term market and the lead time for long-term contracts. The market price path is estimated to shift upward by typically $15, $25, and $50 per pound in the 1990's for the 40-, 30-, and 20-percent limits, respectively, when compared to the "perfect competition" variation of the current policy case. Compared to the case of a utility self-imposed import limit, the successively more stringent produce price shifts of $0, $5, and $30 per pound in the 1990's.

In all import ceiling variations, domestic production is estimated to be almost unchanged from the current-policy case through the mid-1980's. After the mid-1980's, domestic production would tend to rise in concert with its share of domestic requirements. This is in contrast to the "perfect competition" current-policy case, for which imports were estimated to capture the bulk of the domestic market. Because of the projected ability of foreign producers to undercut prices for domestic supplies, import levels would be at the prescribed limit. Thus, a rule of thumb is that domestic production would be no higher than the residual domestic demand after the import limit. By the turn of the century, domestic production would range from 18-26 thousand tons annually.

Import Tariffs

Again, this policy option is estimated not to impact domestic production before the late 1980's. In the mid-1990's, the impact

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on the market price, as paid by domestic consumers, could be about double the tariff level. That is, a $5-per-pound tariff could induce a $10-per-pound higher market price. After the decline in domestic production to an estimated 12 thousand annual tons in 1985, successively higher tariffs would protect the domestic industry and allow growth to 16 thousand annual tons in 1989 for a $10 per pound tariff for example. However, after 1990 an estimated tariff of at least $20 per pound would be needed to keep the domestic industry growing in concert with domestic demand.

Enrichment Transactions

This option is fraught with subtle complications about such things as the terms of DOE and foreign-supplier enrichment contracts. In essence, the situation expands along a new dimension when terms of enrichment services are considered.

In summary and oversimplification, the DOE could increase the so-called "transaction tails assay" of its enrichment contracts, thereby increasing the enrichment customers' requirements for natural uranium feed material. This action would inversely impact the customers' requirements for enrichment services. Since DOE is mandated to base its enrichment prices on a "full-cost recovery" basis, the spreading of less enrichment demand over the same fixed costs would necessitate an increase in enrichment prices. With increased uranium demand implying higher uranium prices, and higher enrichment prices, the cost of finished nuclear fuel is also higher, as shown in Chapter 7.

The impact of this policy change on the uranium market is estimated to be minimal. Beginning in 1986, the policy would induce an estimated $5 per pound higher market price, draw down inventories somewhat faster, and in the long run increase both domestic production and imports about equally (less than 2 thousand annual tons each).

Federal Stockpiling

This option has a limited range of applicability. It would be most effective in buttressing the industry only over the next 8 years or so -- the period when market demand would otherwise be low. Thereafter, the impact of potential imports could be so large as to dwarf a reasonable Government stockpile program.

Government purchases of 5 thousand tons per year could have a transitory impact of about $10 per pound on the market price and cost the Government about $500 million per year. On the other hand, a large strategic stockpile of uranium might be an effective deterrent to possible foreign supply disruptions, if the domestic utility industry were to come to rely heavily on foreign sources of supply.

In summary, the direct import controls (either through direct restriction of import quantities or tariffs) can be designed to be most significant in their potential long-term impact. The theme that emerges from the analysis of these options can be simply stated. The more stringent the level of import controls, the more isolated the U.S. market becomes from the world market. Domestic demand can be supplied only at higher costs for more stringent import controls, since it is estimated that domestic supplies are more costly, on the average, than foreign supplies.

For direct import controls over the long term, the analysis does indicate that the domestic supply industry would be able to expand in concert with the projected expansion in demand, if induced by adequate price signals. It is important to note that the prices required in the long run to induce this expansion are significantly higher than the prices resulting under no import restrictions. Both control of import quantities and restriction through tariffs can have similar effects on the market place.

The analysis presented here does not cover any international legal or foreign policy considerations. Thus, it must be considered as less than fully comprehensive. Furthermore, the analysis system relies of necessity, on simplified representations of market behavior that may not capture future behavioral characteristics accurately. Therefore, the estimates of policy impacts are just that -- estimates based on an assumed set of relationships.

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1. INTRODUCTION

The domestic uranium supply industry, almost from its inception, has been the object of considerable Government attention. The Nation's need for a nuclear arsenal virtually created the industry within the decade of the 1950's. When military requirements had been met by the middle 1960's, the commercial nuclear power industry -- still in its infancy -- was far too small to utilize fully the Nation's uranium supply capacity.

The desire to protect the domestic uranium industry, until the commercial demand for uranium rose to higher levels, led to the 1964 passage of Section 161(v) of the Atomic Energy Act of 1954. This amendment requires the Department of Energy (as the successor to the Atomic Energy Commission, or AEC) to place limitations on the enrichment of imported uranium, intended for use in domestic nuclear powerplants, "to the extent necessary to assure the maintenance of a viable domestic (uranium) industry." This law resulted in a total ban on the enrichment of uranium imported for domestic end use.

By 1974, however, the AEC had determined that such a level of protection would not be warranted for the future. Thus, the AEC announced a new policy to lift the import ban gradually, beginning in 1977, with no import controls by 1984.

Recent declines in the "spot" price of uranium and the potential for development of relatively low-cost foreign supplies have rekindled Congressional concern about the viability of the domestic uranium supply industry. At Congress' request, the Department of Energy (DOE) has carried out a study which recommends the continuing of the present policy course. (See, "The Domestic Uranium Industry and Imports of Uranium;" U.S. Department of Energy; February 23, 1981.) However, the DOE study does identify six alternatives to the present uranium import policy, which could be implemented if and when further action is required. Each of these alternatives is proposed to offer some further degree of protection for the domestic uranium industry.

In March 1981, Senator Pete V. Domenici asked the Energy Information Administration to analyze the future market for uranium under the seven policy options, as a supplement to the earlier report by other elements in the Department of Energy. The results of the requested analysis are presented here.

This report does not contain any policy recommendations, since such activity is outside the Energy Information Administration's charter. Nevertheless, this report does provide estimates of the impact of the seven policy alternatives on various market parameters -- such as price, production, and import levels. These parameters, when considered collectively, provide some measure of industry "viability."

This report first provides background discussion on the uranium industry and how it evolved to its current state (especially the Federal Government's role). Second, the current status of the domestic industry is reviewed with a focus on the outlook for the near-term. Third, the future market under current policy is characterized, followed by estimates of the effects of the other policy alternatives:

1. Deferred Embargo Removal -- Return to the maximum import fraction of 30 percent in 1982 through 1986, with annual successive limits of 40, 60, and 80 percent followed by no import limits after 1989;

2. Import Ceilings -- Beginning in 1982, alternative limits of 20, 30, or 40 percent import fraction at least through the year 2000;

3. Tariff on Imports -- Imposition of an import tariff in order to offset potential cost differences between foreign and domestic production;

4. Modified Enrichment Transactions Policy -- Increasing the demand for uranium by modifying the terms under which enrichment services are provided;

5. International Commodity Agreement -- Implemenation of a buffer stock scheme designed to stabilize prices; and

6. Federal Stockpiling -- Increasing Government stocks of uranium in order to support prices.

Finally, the current DOE uranium data collection effort is reviewed especially considering its adequacy for monitoring the viability of the domestic uranium production industry.

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2. HISTORY OF THE DOMESTIC URANIUM INDUSTRY

(This chapter is synopsized from Firm Heterogeneity, Investment and Industry Expansion: A Theoretical Framework and the Case of the Uranium Industry, by Wesley M. Cohen (Ph.D. Dissertation, Department of Economics, Yale University, May 1981). For complete text with footnotes see the document cited above.)

This chapter describes the history of the domestic uranium industry since its post World War II inception, emphasizing the evolution of market institutions, Government policy, and industry conduct.

Government Monopsony

From the end of World War II until the mid 1960's, the Federal Government provided the sole market for uranium and, as such, was responsible for creating a world industry which would reliably supply uranium for weapons development. During the years of transition to a commercial market (1965-1970), the Government attempted to sustain the production industry until the demand from the commercial nuclear power industry grew sufficiently large. The period of Government monopsony is subdivided into the period of Government incentives (1946-1958) and that of Government withdrawal (1958-1971).

At the close of World War II, uranium supply depended entirely upon insecure foreign sources and a few marginal domestic deposits. In 1948, the AEC created an incentives program to stimulate directly private-sector exploration, mining, and milling. Extending from 1948 to 1958, the AEC program included financial incentives for exploration, mining, and milling; direct participation in exploration, the development of infrastructure; and an extensive research and development program to advance exploration and milling technology. At the same time, the U.S. Government provided the principal international market for uranium, fostering the growth of the industry in Canada and Africa.

Between 1957 and 1958, the AEC precipitously reversed its incentives program. This policy change took place in the face of a quick expansion in mill capacity, sufficient to satisfy projected military requirements for at least 10 years, and the rapid growth of estimated domestic ore reserves.

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In November 1958, the AEC announced that, in the 1962-1966 period, it would purchase at a flat price of $8 per pound only uranium concentrate derived from reserves developed prior to the date of its announcement. The AEC also announced that ore price guarantees would cease in 1962. The AEC began renegotiating its concentrate purchase contracts to reduce the price paid and to limit further the quantity procured for the 1962-1966 period. In 1962, the AEC announced a "stretch-out" plan in which millers were requested to defer voluntarily a fraction of their deliveries (scheduled for 1963-1966) into the 1967-1968 period, with the incentive of a guaranteed purchase in 1969-1970 of an amount equal to the quantity deferred, although the price after 1968 was to be lowered. The $8 per pound price applied until 1968. In 1969-1970 the price varied, but never exceeded $6.70 per pound.

The Commercial Market

The transition to a commercial market for uranium extended approximately from 1964 through 1971, at which time the Government ceased buying uranium. Since 1971, the demand for uranium originated exclusively in the private sector with the Government satisfying its requirements from its accumulated stockpile. The distinctive features of the commercial market were that uranium production now satisfied a new need -- the generation of electrical power by nuclear reactors -- and was associated with a new set of buyers and new market institutions.

Although Government policy did not occupy a dominant direct role as during the monopsonistic period, its indirect role during the period of the commercial market has been critical. The Government's role in the creation of commercial nuclear power indirectly sustained the uranium industry after the end of the AEC's procurement program. Examples of the Federal Government's promotion of commercial nuclear power include research and development activities on the nuclear fission technologies, nuclear power demonstration projects, the provision of low-cost fuel-enrichment services, and the Price-Anderson Act limiting utilities' liability in the event of a nuclear accident. Although discussion of the Government's overall support of nuclear power extends beyond the scope of the present work, it should be understood as providing the context for the uranium industry's recent history.

In 1964, Congress (prompted by the AEC) prepared the way for development of the commercial uranium market with two amendments to the Atomic Energy Act. First, it legalized private ownership of nuclear fuel -- enriched uranium -- as of 1971. The

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prospective private users, the electric utilities, would no longer be required to lease the material from the AEC. Second, in what became known as "the embargo on imported uranium," Congress legislated protection from foreign competition for the domestic mining and milling industry. "To assure the maintenance of a viable domestic uranium industry," the amendment prohibited enrichment of uranium mined abroad for use in domestic reactors. The legislation's symbolic effect was as important to the producers as its substance. The actual and prospective participants understood that the AEC's influence on the market through its enrichment and stockpiling policies would be critical to the industry. The 1964 legislation signaled that the Federal Government would, within reason, attempt to guarantee the industry's viability.

Between 1964 and 1966, the perception developed that nuclear power would provide a rapidly growing share of electrical generating capacity, which itself was expected to grow at a 6-7 percent rate for the foreseeable future. Expected demand for uranium increased concomitantly.

The sequence of events triggering the widespread revision in expected nuclear power growth began in February 1964 with the New Jersey Central Power and Light Company's report on the anticipated cost of generating electricity with its large planned Oyster Creek nuclear power plant. In brief, the report said that nuclear plants could now be purchased to produce power at a cost of 4 to 4 1/2 mills per kilowatt hour, underselling power produced with any fossil fuel including coal. As a consequence of the perceived economic advantage of nuclear power and the higher projections for electrical growth, projections for nuclear power demand were revised sharply upward.

Orders for nuclear reactors confirmed the expectation of rapid growth. In 1964 and 1965, American utilities ordered a total of seven reactors. After 1965, the order rate rose quickly. Utilities ordered 51 nuclear powerplants in 1966 and 1967 with a combined generating capacity of almost 40,000 megawatts. Although the industry assumed that the breeder reactor would eventually displace the need for new uranium, it was not expected to be an important factor before 1990.

In 1964-1966, the sharp upward revision in the expected growth of nuclear power, combined with supportive Federal legislation, stimulated a major resurgence in private sector interest in the uranium industry. Uranium exploration increased immediately. As measured by total drilling footage, exploration in 1966 almost doubled the 1965 activity levels. In 1967 and 1968, the previous

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year's level of activity was approximately tripled. The increase in exploration activity represented both a resumption of activity by firms previously in the industry and exploration undertaken by new entrants.

After 1970, prospects for the industry dimmed. Reactor order slippages and construction delays resulted in a decline in expected demand for uranium. The AEC projections of the 1990 installed nuclear power capacity made in 1970, 1972, and 1973 dropped from 150 to 132 to 102 gigawatts, respectively. Industry participants noted the decline, but on the whole, did not believe that these downward revisions were indicative of any long-term trend although the downward revisions in demand forecasts were to continue.

In addition to demand uncertainty created by the reactor order slippages, uncertainty was also created by changing Government plans on:

1. the release of Government stockpiles of enriched uranium;
2. the possible variation in the enrichment tails assay affecting the amount of feedstock uranium required to produce a given amount of enriched uranium; and
3. the authorization to permit the enrichment of imported uranium for use by domestic utilities.

Compounding the uncertainty surrounding market demand, the real price of uranium was declining through the beginning of 1973. Despite the producers expectation that the price of uranium would begin to increase by the early 1970's, the average real price in 1981 dollars dropped from $18.50 per pound of uranium concentrate in 1969 to $12.40 per pound in 1972.

An industry cutback in exploration activity between 1970 and 1973 is commonly explained by the declining real price, reduced demand projections, and market uncertainties. Indeed, exploration did decline. Having reached a high in 1969 of over 29 million feet, exploratory drilling dropped to 18 million feet in 1970 and then to 11 million feet in 1971. Drilling continued at about 11 million feet annually through 1973. However, explaining behavior at this time in industry-aggregate terms and suggesting that all producers were cutting back in response to the same disincentives obscures significant differences in the way firms behaved. Not all participants in the industry reduced their exploration behavior. An examination of corporate documents, annual reports, and company filings with the Securities and Exchange Commission from this period indicates that, while a number of firms were cutting back (like Union Carbide) or withdrawing altogether (like AMAX), other firms were maintaining a constant or even increasing level of exploration activity.

As background to a discussion of pricing during the commercial market, it should be understood that no centralized futures or spot market exists for uranium. Contracting for uranium is negotiated either bilaterally between a producer and a utility, through a middleman such as a nuclear power plant manufacturer, or through a broker. A principal broker for uranium is the Nuclear Exchange Corporation (NUEXCO) founded in 1968. NUEXCO's published "exchange value" is typically referred to as the "spot price" for uranium. Properly speaking, however, the exchange value is only a rough index of what a spot price might be if there existed a centralized spot market. The exchange value, as currently defined, is NUEXCO's estimate of the price at which transactions for immediate delivery could have been concluded as of the last day of the month. With regard to forward contracting, forward-delivery prices and contract conditions may differ even in contracts signed at the same time for delivery of uranium at approximately the same future date.

Throughout the early history of the commercial uranium market, the price of uranium has behaved erratically. From 1970 through 1973 the price remained lower than conditions of excess long-term demand should have allowed. Beginning in late 1973, the price finally began to ascend, but at a rate which surprised industry participants and observers alike. It would seem paradoxical as to why the price of uranium declined between the late 1960's and 1973 although its expected demand far exceeded contracted deliveries for the period from the mid-1970's forward.

One explanation for this apparent inconsistency is offered by Paul Joskow in "Commercial Impossibility, the Uranium Market and the Westinghouse Case," Journal of Legal Studies, 1977. Joskow states that supply overcapacity, left in place after the AEC procurement program, held down prices in the period through 1972 as utilities contracted for only their short-term needs. In the 1972-1973 period, requirements over the subsequent 5-year period were well in excess of contractual commitments. Utilities, which had little experience in dealing with uranium producers, apparently had the (mistaken) impression of easy long-term availability -- an impression that was buttressed by the market actions of Westinghouse. Thus, there was no perceived need by the utilities to enter into contracts for long-term supply.

Beginning in 1973, the uranium market changed dramatically. The nominal spot price for a pound of uranium concentrate jumped by over 500 percent within 2 1/2 years. Inasmuch as the cause for the price rise is a subject of ongoing controversy and litigation, only a tentative explanation for the price rise will be offered. The price rise, in general terms, resulted from the combination of a convergence of immediate requirements to industry capacity and a surge in long-term contracting, compounded by a number of institutional peculiarities associated with the uranium market at that time.

By January 1975 the spot price reached \$16 per pound and by September 1975 it had reached \$26 per pound. At that time, Westinghouse announced that, due to "commercial impracticability," it was unable to deliver about 75 million pounds of uranium concentrate, which it had contracted to sell in a middleman capacity to 29 utilities. The explanation offered by Westinghouse was that, since the time its contract commitments were made, the price of uranium had risen so much that honoring the contracts would cause unacceptable financial hardship for the company. As a consequence of the abrogation of their supply contracts, the affected utilities reentered both the spot and the long-term markets. Thr price of uranium rose to \$40 per pound by April 1976.

Paralleling the growth in spot demand, long-term contracting also began to increase rapidly for several reasons. First, by changing the utility contracting procedures for enrichment services in 1975, the AEC pulled utilities into the long-term uranium market. The existing "requirements contract" regime required that utilities specify their enriched fuel requirements only 180 days in advance of the proposed delivery date. In January 1973, the AEC announced that its new enrichment clients would be required to sign long-term, fixed-commitment contracts, specifying the quantity of enrichment services required over a moving 10-year period which would begin on the date of enrichment of fuel for the initial reactor core. The contracts had to be signed 8 years in advance of the initial requirement and included a penalty charge for changes in contracted delivery schedules of 50-75 percent of the value of the service. To avoid either incurring substantial penalties or leaving their nuclear reactors idle, many utilities began contracting for enrichment services. To match their enrichment contracts with the required uranium feed materials, the utilities in turn entered into long-term supply contracts with the uranium producers.

As a consequence of these factors, long-term forward contracting more than doubled between January 1973 and January 1975 as

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measured by the sum of contracted future delivery for 5 to 8 years forward. This additional long-term contracting increased the 5-to-8 year forward coverage of projected industry requirements from approximately 25 percent in 1972 to 60 percent in 1975.

As the demand for long-term uranium contracts increased, contracting provisions began to change. Until this time, long-term contracting had conventionally been fixed price with an inflation escalation provision. In 1973, when the utilities began issuing a significant number of invitations to bid on this basis, the invitations went unanswered. Producers resisted signing such fixed price contracts because, first, they believed that the contracts would not reflect the higher spot prices now anticipated for the near future. Second, they were already losing money delivering on previously signed, fixed-price contracts which did not reflect recent increases in production costs. In 1974 more flexible "market price" contracts came into vogue, to which the producers responded. This contracting mode typically pegged the future delivery price to the "world market price" prevailing at the time of delivery. Most market-price contracts also guaranteed the producer a base rate of return on investment. In a short time, market-price contracts became the norm as forward contracting accelerated.

As the buyers' market became a sellers' market in 1973-1974, producers expanded their exploration programs and new entry was spurred. Total drilling increased from 17 million feet in 1973 to 21.6 million feet in 1974 and to 48.1 million feet in 1978. Development drilling grew proportionately more than exploration drilling, representing both an effort to accelerate mine development and to increase confirmed reserves to obtain financing and show the utilities that they, the producers, could indeed deliver on a long-term basis.

Mine and mill development proceeded in two waves during the 1970's. The first wave of entrants and capacity expansions between 1971 and 1976 reflected the optimistic expectations of the mid- to latter 1960's. The second was a response to the sellers' market which began in late 1973. The delay between the impetus and the start of operations in each case resulted from the lag time between initiation of exploration and mine/mill installation. De novo entrants into the milling segment during the first wave included Continental Oil and Pioneer Corporation (1971 in a joint venture), Exxon (1972), Rio Algom (1972), and Sohio and Reserve Oil and Minerals (1976 in a joint venture). Corporations which expanded milling operations included Utah International, Union Carbide, and Phelps-Dodge (which entered via acquisition of Western Nuclear in 1970). The second-wave firms,

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which either opened mills in 1979-1980 or were planning mills for the early 1980's, included Utah International, Union Pacific (Rocky Mountain Energy), Phelps-Dodge, Southern California Edison, Homestake Mining and Commonwealth Edison. Also in the late 1970's, a number of firms (including Mobil Oil, Union Carbide, and Westinghouse among others) began operating nonconventional plants for uranium extraction, such as in-situ leaching and phosphate recovery.

In addition to the entry of additional mining firms and small uranium firms, the rapid transformation into a sellers' market induced the entry of the consumers themselves, the utilities, and of reactor manufacturers, such as Westinghouse and General Electric. The utilities began to enter various stages of the industry in response to the sharp price rise and the supply insecurity signalled by the Westinghouse default. Concerned with protecting the investments in their nuclear powerplants, many utilities decided to integrate upstream beginning in 1974. The first utility to produce its own concentrate was Commonwealth Edison which took over Cotter Corporation, a cash-poor uranium independent with its own mill. Through its subsidiary (Wyoming Mineral), Westinghouse entered the uranium industry using nonconventional extraction technology. In 1976, General Electric acquired Utah International, a diversified mining firm and a major uranium producer.

Utility entry took various forms. As of 1980, utilities were involved in exploration, reserve development, mining, and uranium concentrate production. Either lacking their own expertise or the willingness to acquire a producer, most utilities entered exploration, mining and/or milling as party to a joint venture with an existing industry participant. Utilities also began providing producers with "front-end" money to finance exploration and development. Such preproduction payments assisted the smaller firms, in particular, which otherwise would have had difficulty in financing exploration.

By 1979-1980 the sellers' market came to a close. Although the "real" price (after adjusting for inflation) has declined since 1976, a sharp decline in the nominal price of uranium began in early 1980, dropping from over $40 per pound at the end of 1979 to $23.50 per pound by August 1981. In real terms, the price in August 1981 was less than half of what it had been in 1976. The reasons for this transformation are several. First, the spot demand for uranium declined as reactor operations were affected by regulatory restrictions and near-term installation dates were postponed. Reflecting a condition of excess supply, the utilities' inventory of uranium grew excessively as they took delivery on their long-term contracts with no immediate use for

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the fuel. The year-end inventory level, measured in uranium concentrate equivalent, grew from 23,700 tons in 1975 to 54,400 tons in 1980. Uranium purchases, however, did not fully reflect the actual decline in the growth rate of demand until 1979, when DOE implemented "adjustable fixed-commitment contract" procedures for their enrichment operations. The new procedure allowed the utilities to adjust enrichment feed delivery schedules to correspond more closely to actual requirements. The change is estimated to have decreased near-term U.S. demand by about 12 percent.

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3. CHARACTERIZATION OF THE NEAR-TERM URANIUM MARKET

This chapter presents information on the current status of the uranium market and the uranium-producing industry. In addition, a framework for analyzing the policy options is developed. This framework begins with simple diagrams of expected market interactions and then describes a quantitive tool for analyzing these policies.

Current Status of the Market

The earlier DOE report (The Domestic Uranium Industry and Imports of Uranium, released in July 1981) provides extensive information on the uranium market -- information that was current as of mid-year 1980. Since the earlier report was finalized, more recent data on the U.S. market status have been released. (See Survey of United States Uranium Marketing Activity, Report DOE/NE-0013, U.S. Department of Energy, June 1981.)

Significant new information revealed by the DOE market survey of January 1, 1981, is the following:

1. New purchase commitments in 1980 (12,500 short tons of uranium concentrate) were exceeded by reductions in commitments (25,600 tons.) Thus, there was a net reduction in commitments of 13,100 tons of uranium concentrate. (See Table 3.1.) Never before in the history of the DOE market survey has there been a reduction.

2. An additional 900 tons of uranium was exported in 1980 than had been anticipated at the beginning of 1980. Thus, the United States was a net exporter (by 1,100 tons) in 1980.

3. Buyers' inventories of uranium increased from 36,100 tons of natural (unenriched) uranium on January 1, 1980, up to 45,100 tons on January 1, 1981. In addition, inventories of enriched uranium increased to 19,300 tons of natural uranium equivalent at the beginning of 1981, up from 16,200 tons a year earlier. (See Table 3.2.)

4. Market price contract settlements made in 1980 for delivery in 1980 were at an average price of $34.05, which is somewhat above the mid-year 1980 "NUEXCO" exchange value of $31.50.

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The market survey report contains additional information about market prospects over the next 10 years. For example, Figure 3.1 shows the status of the domestic demand side. Secured supplies are indicated as "contracts" among domestic buyers and domestic or foreign producers. The total potential demand on the uranium market is shown as the sum of "contracts" and "unfilled requirements." Unfilled requirements are defined as "additional uranium needs of utilities and reactor manufacturers after consideration of their total future requirements less inventories and deliveries under existing procurement contracts."

Projected deliveries of natural uranium by domestic customers to the DOE enrichment complex, "total requirements", are the final data shown in Figure 3-1. For 1981 and 1982, deliveries to DOE are well below contracted deliveries to uranium consumers, indicating a continued buildup of consumer inventory levels. Beginning in 1984, however, the total market demand each year is less than projected deliveries to DOE. This latter situation reflects current plans for draw down of consumer inventory levels, as discussed later.

The situation on the supply side, as characterized by the latest survey report, is shown in Figure 3.2. Again contracted deliveries with domestic producers are shown as the bottom curve (with export contracts included.) The top curve beginning on the left ("Total Domestic Supply") accounts for "Estimated Uranium Available for Sale," information provided by domestic producers.

The last curve shown is that of domestic producer contracts added to unfilled requirements, the latter as defined before. Thus, absent a further export market, this curve is the total market demand for domestic producers. Note that potential supply exceeds potential demand by several thousand tons annually through 1986. Thereafter, producers apparently have no plans for expansion to meet this potential demand.

The factor we have not yet considered in detail is the potential disposition of consumer inventories. Figure 3.3 shows what might be considered bounding cases for inventory disposition. Total requirements for delivery to the DOE enrichment complex are shown, along with the "unfilled" fraction of these requirements.

The top curve, "Inventory (No Utility Sales)", shows the projected level of buyer inventories on the basis of deliveries from uranium contracts currently in place and assuming that unfilled requirements are fulfilled eventually by domestic or

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foreign production. By 1990, buyers would still have more than one-year's forward coverage of their requirements in inventory.

The last curve of Figure 3.3, "Inventory (Maximum Utility Sales)", shows projected inventory levels as computed before, except with all unfilled requirements met from buyer inventories. This curve implies that, in the aggregate, domestic buyers could meet all their uranium needs through 1988 from currently contracted deliveries plus current inventories.

One obvious issue then concerns the probability of movement of inventory from consumers with an excess to consumers with unfilled requirements. About 800 tons of uranium were sold from buyer inventories in 1980 -- a rather significant amount in terms of unfilled requirements at the beginning of 1980. Some of this material might account for the additional one thousand tons of exports made from the spot market in 1980.

There are also indications that 75 percent of these utility sales was purchased by domestic producers and used to fulfill their commitments for delivery. This action may be expected if, for example, the material could be purchased on the spot market by the producer at a price lower than his marginal production cost. Under these circumstances, the producer would cut back his production and buy the material on the open market since his resulting profit would be increased by this action.

To summarize the current status of the domestic market:

1. 1980 witnessed, for the first time, a reduction in delivery commitments (meaning that more contracts were cancelled than were signed.)
2. The current market price is apparently below the operating costs of most domestic producers. Old contracts with higher imbedded prices will provide a buffer for a decreasing fraction of producers, but some may choose to cut back operations and purchase material on the spot market to fulfill their commitments.
3. Consumer inventories are well above the desired one-year forward coverage and will probably remain so through the mid-1980's. This allows the possibility of a significant level of sales from consumers' excess inventories, in direct competition with sales from domestic production.

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4. Consumers' unfilled requirements are scant through the mid-1980's.

5. Because of the oversupply situation, there is little incentive for the market price for new contracts to increase over the next few years.

These observations set the tone for consideration of investment in new production capacity and the impact of the various policy options discussed next. The near-term future does not look promising for the domestic uranium production industry expansion. On the contrary, it appears that major reductions in size are occurring and will continue.

The "light at the end of the tunnel" for producers is the increasing amount of unfilled requirements in the latter half of the 1980's. However, there is the danger that if commitments are not made in a timely manner, there will be insufficient domestic production capacity to meet these requirements.

Costs of Production

Domestic uranium producers' mining and milling costs have risen faster between 1978 and 1981 than the industrial component of the Wholesale Price Index (WPI) or the average inflation rate, as measured by a broader index (such as the GNP deflator of the Council of Economic Advisors.)

The more inflationary condition in the uranium mining industry was caused by many factors, the most prominent of which were:

- sharply increasing production levels
- declining worker (and capital) productivity
- steep price increases in mining equipment and construction for mine development.

The 1978-1981 period witnessed increases in the unit mining costs of uranium producers which ranged from 30-40 percent. The cost of surface, or open pit, mining increased more rapidly, largely because of the greater proportion of (diesel) fuel and heavy equipment in surface mining costs. The prices of these factors of production increased as much as 30 percent in a single year.

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Table 3.3 summarizes the growth in mining costs for a sample of some of the more typical mine configurations. Cost increases can be seen to vary from 25 percent to almost 45 percent in 2 1/2 years, and typically range from 32-40 percent (or between 11 percent and 15 percent annual) inflation. The net inflation over this period has taken place despite a serious deflationary condition in 1981, which is characterized by large scale miner layoffs and a significant degree of mine shutdown.

The effect of these increased costs (which were measured above at the operating cost level) has been to require a much higher product price to permit profitable continuity of operation.

Figure 3.4 summarizes the additional reserves that could be brought into ore (mining) production in 3 successive years -- 1983, 1984, and 1985 -- at various levels of break-even cost. Break-even cost in this instance reflects a complete cost recovery of all out-of-pocket costs, as well as non-cash charges such as, depletion and depreciation which would recover the owners or investors' capital fund corpus, but provide no direct return to that capital, nor payment for its use.

This statistic is indicative of the base threshold at which capital will be absolutely withheld from any further investment, and furthermore will be extracted (from existing projects) whenever possible.

Discounted cash flow return analysis has been used elsewhere in this analysis to reflect investor incentives more accurately. Needless to say, the requirement of a 15 percent discounted cash return to investor funds leads to a higher market price level which would permit new resources to be brought into production.

As Figure 3.5 shows, a $30 break-even price (1981 dollars) per pound of uranium oxide would be necessary for the least amount of new reserves to be brought into production, and a $35-40 price for any appreciable quantity to be developed. About 10,000 tons fall below the $30 break-even point, whereas 68,000 tons of reserves could be mined (and milled) at a break-even rate of $40.

These reserves would result in annual production capability of only 1,500 additional new tons at a break-even price of $30 and 15,500 annual tons (almost a doubling of present production capability) at a break-even cost of $40. (This is gross production added, not net of those existing in production facilities that could not break-even at $30.) Significant

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additional quantities (over 40,000 tons uranium concentrate per year) could be produced at a break-even condition for prices between $50-60 per pound.

Various concepts of minimum acceptable price have been used to identify the point at which an industry will prefer shutdown to the continuation of unprofitable operations (much less deepen investments in new production facilities). Forward costs have been used historically (principally by the U.S. Government) to identify this threshold in the uranium industry. Forward costs differ principally from break-even costs by permitting recovery of new capital funds, but not upon past historical or sunk capital funds. In general, it can be said that when a producer has a break-even investment, i.e., one that is not earning any interest or return, he is not prone to increase that investment regardless of new assurances of future return contained in "forward cost" forecasts, until the present funds are earning higher returns than would occur at the break-even point.

Few investment advisors or analysts would encourage any investment at other than a rate of return which fully compensates the investor for the lost opportunity to earn common interest on his capital plus an additional rate of compensation to cover the business or market risks that may be involved in a particular project.

A riskless rate of return would consist of 2-3 percent annual return plus an amount that would compensate for any loss of monetary value due to inflation.

Resource and mining activities are generally considered an especially risky class of investments. Management within the mining and mineral industries have used a 15 percent Discounted Cash Flow (DCF) internal rate of return as a long standing benchmark for project evaluation. Although the industries involved have not consistently realized such a rate of return historically, it can be easily accepted that if such a long standing target has not been achieved by actual results with any consistency, any lower standard of estimation would hardly improve the industry's future prospects of realizing that goal.

We have used the break-even costs shown above as the absolute threshold for disinvestment, or measure of the viability of continuing present operations. If viability of the industry is viewed less myopically, that is, to include also consideration of future need (including growth of reserves and production capability to serve future market needs), a more robust concept

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of earnings, such as the inclusion of a 15 percent discounted rate of return on all investment (past and prospective) should be used. A 15 percent DCF rate has been used in the balance of this analysis to reflect an appropriate producer/investor criterion for continued industry development.

Average uranium contract prices continue to cover the costs of many producing investments in the uranium industry at the level of the floor prices (as shown in Figure 3.6.) These contracts, however, only cover a (rapidly declining) fraction of the future requirements of the U.S. commercial power industry. Figure 3.7 illustrates the declining quantity of contractual coverage.

A visual comparison between Figures 3.4 and 3.5, on the one hand, and Figure 3.6, on the other hand, suggests that there is an ability to profitably produce the contract commitments from existing or selected future production centers. However, as Figure 3.7 suggests, if this were the only source of uranium markets above present spot price levels, it would most likely lead to a decline of the present industry production capability to about 1/2 of its (1980) peak level by 1983, and 1/4 of that peak capacity by 1989.

An Analytic Framework

To place policy options in some market context, the following demand and supply diagram approach is useful. Figure 3.8 shows a simple representation of how supply and demand may be seen to be brought into balance through the determination of a "market-clearing price." Supply is represented as a "supply curve" which varies (increases) in quantity as the price for the good is increased. "Demand" for the good is usually represented as a curve sloping in the opposite direction from supply. This represents the notion that, as the price of a good increases, less will be demanded since the consumers will increase the efficiency of their overall consumption or else turn to substitutes for that good.

The market-clearing price is then determined from the intersection of the demand and supply curves, it is the price at which suppliers would just match the demand for consumption of their good.

For the case in which suppliers and consumers can be segregated into subgroups, this presentation can be carried a step further, as shown in Figure 3.9. Suppose these subgroups correspond to geographical or political regions, as, for example the "Domestic Market", shown on the left of the figure, versus the "Foreign Market", shown on the right hand side of the figure.

If there were no international trade between these two groups, this simple representation implies that a "Domestic Market Price" would be determined by the balancing (intersection) of the domestic supply curve against the domestic demand curve. Similarly, the intersection of the foreign supply curve and the foreign demand curve would determine a "Foreign Market Price."

Alternatively, it would be mere coincidence if the separately determined market prices turned out to be identical. Actually, value difference between a domestic and foreign market price encourages international trade, (see Figure 3.10.)

In the example shown, the domestic market price is higher than the foreign market price. The opportunity for international trade, in this example, follows from the realization that, at prices intermediate to the domestic and foreign market prices, domestic consumers could demand more of the good and foreign producers would supply more of the good.

In the center of Figure 3.10, international trade is represented. The demand for imports by the domestic consumers is the segment of the domestic demand curve in excess of domestic production below the domestic market price. The supply of exports from foreign producers is the segment of the foreign market supply curve that exceeds the foreign demand above the foreign market clearing price.

The intersection of the foreign export supply curve and the domestic import demand curve, under the assumption of free trade, determines a "world market price" at a point between the foreign and domestic market prices.

It is important to note that the world market price, in this example, now determines the quantities supplied and demanded in both markets. Domestic demand is larger than the isolated market case, but imports will be larger than just this additional demand because domestic supply will be lower at the new (lower) market-clearing price.

If all consumers buy and all producers sell at the world market price (determined by the international trade representation),

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several factors appear. In this example, domestic consumers and atenjoy more of the good andt lower cost to them. There would be fewer domestic producers (or less production), and the profits from domestic production would be smaller because of the lower price level.

Foreign producers would derive higher revenues both from the higher level of prices and the greater quantities that they supply. Foreign consumers, conversely, must pay more than in the isolated market case and, as a result, consume less.

Although this simple-minded approach is probably not totally applicable to any market, consideration of these concepts lends some global perspective and may indicate the direction of expected trends for various types of market intervention policies. The six alternatives to the present Federal uranium policy, under consideration here, propose various means of Government intervention in the uranium market place, and each is intended to shift the market to some intermediate condition between the two situations discussed above.

These policy options can be broadly categorized as those which are intended to (1) provide for some direct degree of isolation for the domestic market, or (2) affect either the domestic demand curve or supply curve.

Direct Isolation Policies

The restrictions on the domestic use of foreign-origin uranium ("import ceilings") and the "import tariff" proposal are examples of options to separate, to some degree, the domestic and foreign markets.

The import ceiling (as a limit on the percentage of domestic use that can be imported uranium) is illustrated in Figure 3.11. The interpretation of this option is the following. At some point along the import demand curve in the center of Figure 3.11, its quantity would exceed that allowed by the import restriction. Clearly the level of restriction must be sufficiently large so that it operates to the left of the "free trade" (import demand/export supply) crossover point, elsewise the restriction would have no effect.

When effective, the restricted import demand curve intersects the foreign export supply curve at a lower price and quantity than for the free-trade case. Thus, imports are less and, in addition, it is possible for a two-tiered price structure to develop, under conditions of producer competition. In the example shown here, a "domestic" price could develop at a higher level than the "foreign" or "international trade" price.

Another way to isolate partially the domestic from the foreign market would through the setting of a tariff on imports, the case illustrated in Figure 3.12. In the case of a constant tariff per unit of import, the "Export Supply" curve of the free trade case is displaced upward in price by the amount of the tariff. Thus, the domestic market clears at a higher price than free trade, domestic production is higher, imports are lower, the foreign market clears at a lower price, and the tariff-collecting body acquires revenues.

Domestic Demand-Supply Curve Shifts

The second main group of policy alternatives is that of directly altering the demand curve, supply curve, or both. The last three options, outlined in the Introduction, are examples.

The enrichment transactions change is illustrated in Figure 3.13. The implication of this policy is that the domestic demand quantity, at a given price, would be shifted by some percentage. Since a share of the foreign enrichment market is supplied by the United States, the foreign demand curve would also be shifted to higher quantities, by the proportional share. As suggested by Figure 3.13, the "Import Demand" and the "Export Supply" curves are shifted to higher price levels, thus clearing the "free trade" market at a higher price. This configuration means more domestic and foreign production and consumption of uranium.

Another option, development of larger domestic stockpiles by the Government, alters only the domestic demand curve in a fashion similar to the left-hand-side of Figure 3.13. In this case, one might expect the world market to clear a price higher than with no stockpile demand. Thus, higher domestic production levels would result, but not on a one-to-one basis with increased demands. Imports could also increase.

The international commodity agreement is illustrated in Figure 3-14. The agreement would operate in the following way. A minimum and a maximum world price would be determined by the parties to the agreement. A "buffer stockpile" would be set up to alter the "international trade" curves so that, at the minimum price, the import demand increases to large quantities until the market clears. On the other extreme, at the maximum price, the quantity supplied increases to large quantities.

If the external market were not to clear above the minimum price, stockpile purchases would be made to support the price. If the market were not to clear below the maximum price, stockpile sales would be made to hold down prices.

These illustrative representations do not account for many real-world phenomena, especially the dynamics of market evolution and potential non-competitive behavior by market participants. Nonetheless, the qualitative expectations elicited from these diagrams should be kept in mind when considering the policy options in more detail. Projected market behavior that contrasts with these simple considerations should be carefully validated.

The Quantitative Analysis System

To estimate the quantitative impacts of the specified policy options on the uranium market, a modified version of the "EUREKA" uranium analysis system was used. EUREKA was developed by Dr. Don R. deHalas of the Colorado Nuclear Corporation in the mid-1970's. This system incorporates many of the factors identified in the the previous section to be potentially important to the uranium marketplace. The system simulates the decisions that various uranium participants must make and does so sequentially on a year-by-year basis. For example, it assumes that uranium buyers enter the market place for uranium on the basis of their expected forward requirements -- expectations which may change with time. For initial year of the simulation, the utilities' own expectations are used; however, as the simulation proceeds, these expectations become gradually transformed to a different, postulated requirements curve, e.g., the EIA midcase.

Although there is no comprehensive world supply/demand balance in this domestic analysis system, it does have a representation of imports and exports. The first year of the simulation begins with uranium supply contracts (domestic, import and exports) currently in place. Annually, the buyers implement supply contracts in a pattern that commits greater fractions of their expected forward requirements. Buyers commit first to unsold domestic capacity, if such existing and planned capacity is projected to be available. If unsold domestic capacity is not available, buyers are assumed to commit to import contracts or deplete excess inventories. The supply of imports has an upper limit, determined by balancing the world market in a simpler exogeneous system. The exogenous system is based on production center cost data provided by the Nuclear Assurance Corporation and demand schedules consistant with the EIA official forecasts for domestic and foreign programs. In a manner outlined in the previous section, import supplies are determined as a function of economic cost. The correlation of these import supplies with the same economic costs for domestic production permits the development of a function relating import supply to domestic production. This representation removes any consistent bias in the production cost data.

Although demand expectations are specified in a purely exogeneous manner, the domestic production capability and, by the correlation described above, import supply are assumed to evolve in response to another market variable -- price. A characterization of the assumed resource endowment is made, based on such features as grade, depth, and size of deposit. An exploration program is assumed to be carried out, at the levels determined by future need and retained earnings from uranium sales. As deposits are simulated to be discovered, their production costs are evaluated, using the appropriate technological model.

If the projected production cost compares favorably with the projected price, various development activities (including mine and mill construction) are carried out. This development decision is reviewed each year of the simulation. The costs are updated, based on projected changes in factor inputs (labor, chemicals, etc.), and the expected profit is updated, based on any changes in the trend of price over the previous year. Development continues if the expected profit is adequate, but development activities are discontinued for years during which the expected profit is not adequate.

Two types of prices are projected by the simulation. The market price in a given year is associated with new contracts, signed in that year. The market price is initialized to a known value at the beginning of the simulation. As the simulation evolves, the market price is modified on the basis of expectations for "uncommitted requirements" (a measure of buyers actively in the marketplace) as compared to "unsold domestic production capacity" (including some fraction of excess inventories), both over a forward-looking period. If uncommitted requirements exceed unsold capacity, the market price is adjusted upward and vice versa.

The "average delivered price," projected for a given year, is the

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weighted average of prices for deliveries in that year from previously-signed contracts and the settlement of "market price" contracts. It is, therefore, a measure of current revenues -- in contrast to the market price, which determines the propensity for development of new capacity.

The analysis system projects drilling activities (exploration and development) and market activities. Market activities include buyers' inventories, producers' ore stockpiles, production, imports, exports, and prices.

Characteristic of this analysis system is a pattern of fluctuations in price and production capacity with appropriate time lags between. For example, a rapid rise in the market price (resulting from an expected supply shortfall) induces a lagged increase in production capacity. The time constants that characterize these responses are associated with average development times. Since, in actuality, these times are unique to individual projects, the timing and magnitude of price and quantity fluctuations should not be interpreted too literally. Rather, these fluctuations should be considered as general indicators of projected erratic behavior in the market.

In order to account for uncertainity in the input data, some 30 cases were developed for each policy. These cases were developed to cover a wide range of market and technological conditions, and the measure of the impact of policy changes can be determined from the average of the impact on the 30 variations.

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TABLE 3.1 DOMESTIC URANIUM DELIVERIES AND COMMITMENTS* AS OF JANUARY 1, 1980, AND JANUARY 1, 1981

		TONS U_3O_8
PAST DELIVERIES PLUS FORWARD COMMITMENTS (1/1/80)		328,300
CHANGES DURING 1980:		
TOTAL NEW PURCHASES DURING 1980	12,500	
CHANGES TO 1/1/80 COMMITMENTS	(25,600)	
NET CHANGE		(13,100)
PAST DELIVERIES PLUS FORWARD COMMITMENTS (1/1/81)		315,200
DELIVERIES:		
PRIOR TO 1980		140,000
DURING 1980		17,500
FORWARD COMMITMENTS (1/1/81)		157,700

*DELIVERY COMMITMENTS BETWEEN DOMESTIC PRODUCERS AND BUYERS; TRANSFERS BETWEEN PRODUCERS OR BETWEEN BUYERS ARE NOT INCLUDED.

SOURCE: SURVEY OF UNITED STATES URANIUM MARKETING ACTIVITY, REPORT DOE/NE-0013 (JUNE 1981)

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TABLE 3.2 URANIUM INVENTORIES HELD BY BUYERS
(TONS U_3O_8 EQUIVALENT)

	ALL BUYERS			UTILITIES		
	AS OF 1/1/79	AS OF 1/1/80	AS OF 1/1/81	AS OF 1/1/79	AS OF 1/1/80	AS OF 1/1/81
NATURAL URANIUM	33,200	36,100	45,100	25,600	27,600	37,700
(FOREIGN-ORIGIN)	(5,200)	(5,300)	(5,000)	(3,000)	(3,400)	(3,500)
ENRICHED URANIUM	11,500	16,200	18,300	10,000	15,200	16,700
(FOREIGN-ORIGIN)	(200)	(400)	(700)	(200)	(400)	(600)
TOTAL URANIUM	44,700	52,300	63,400	35,600	42,800	54,400
(FOREIGN-ORIGIN)	(5,400)	(5,700)	(5,700)	(3,200)	(3,800)	(4,100)

SOURCE: SURVEY OF UNITED STATES URANIUM MARKETING ACTIVITY, REPORT DOE/NE-0013 (JUNE 1981)

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Table 3.3 Summary of Operating Cost Increases Between 1978-1981 For Various Uranium Mine Configurations

DEPTH	TYPE	ORE GRADE	DEPOSIT SIZE COST	1978-81 INCREASES
Shallow	Underground	Low	Average	44 percent
Shallow	Underground	Low	Large	25 percent
Average	Underground	Low	Average	27-31 percent
Average	Underground	Average	Average	
Average	Open Pit	Average	Average	42 percent
Average	Open Pit	Average	Large	31 percent
Average	Open Pit	Above Avg	Average	42 percent
Average	Open Pit	Above Avg	Large	32 percent

Average size = 2-3000 tons uranium concentrate contained

Average grade = .08 - .11 percent uranium concentrate

Average depth
Underground 750-1000 feet
Surface Mine 250 feet

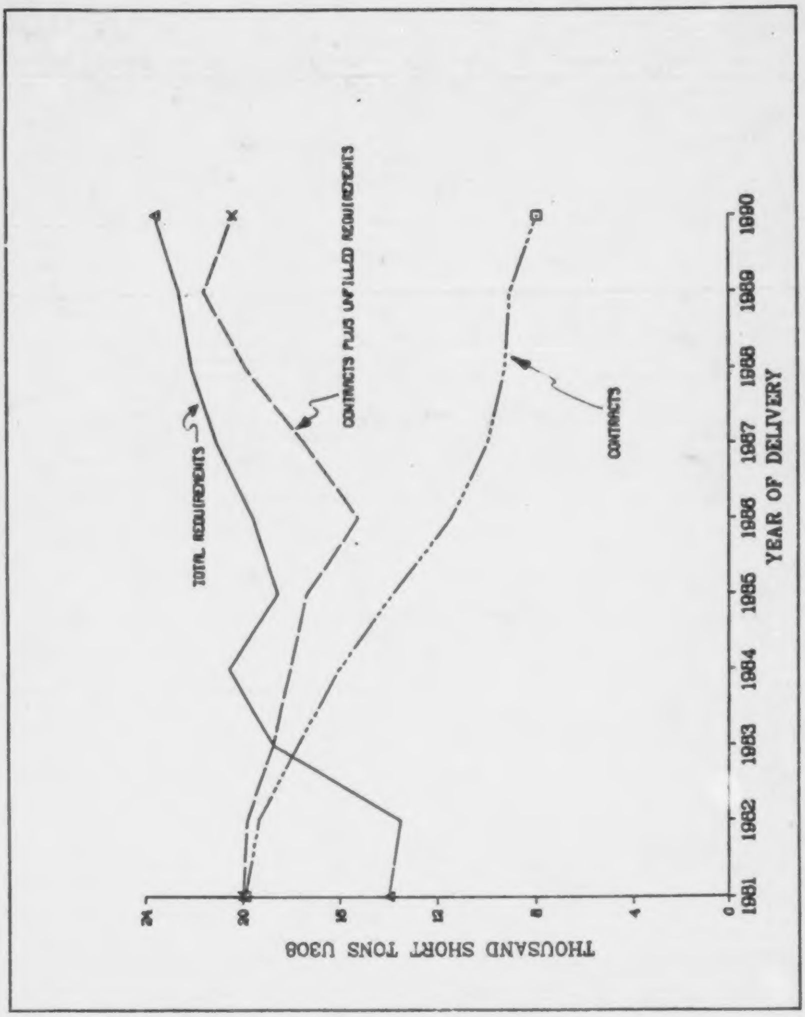

FIGURE 3.1 PROJECTIONS OF URANIUM REQUIREMENTS BY DOMESTIC ENRICHMENT CUSTOMERS

Figure 3.2 Projections of Uranium supplies By Domestic Enrichment Customers

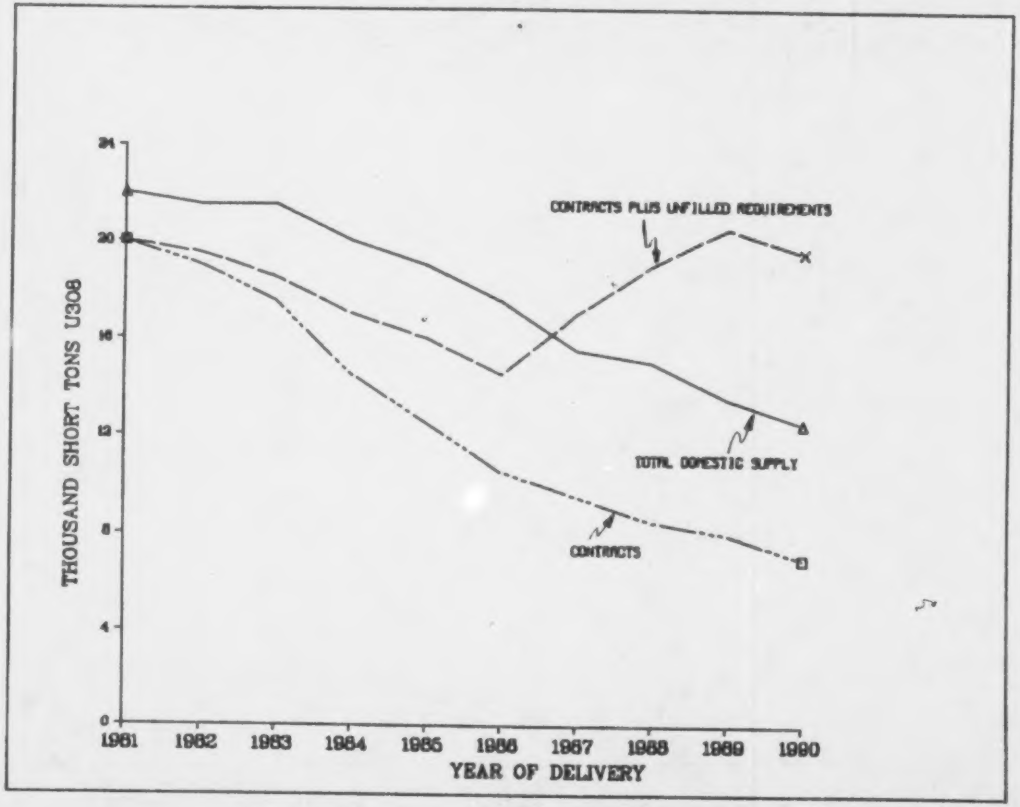

FIGURE 3.3 PROJECTED URANIUM REQUIREMENTS AND INVENTORIES OF DOMESTIC UTILITIES

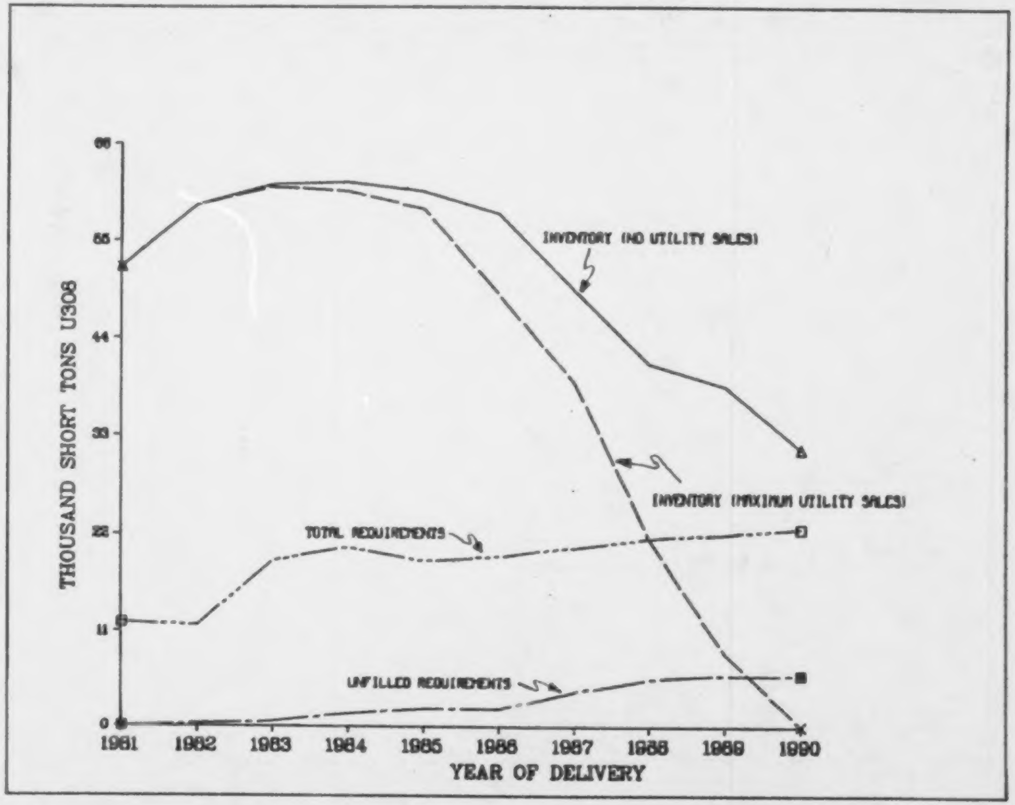

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FIGURE 3.4 INCREMENTAL RESERVES AVAILABLE AT BREAKEVEN PRICES (CONSTANT 1981$)

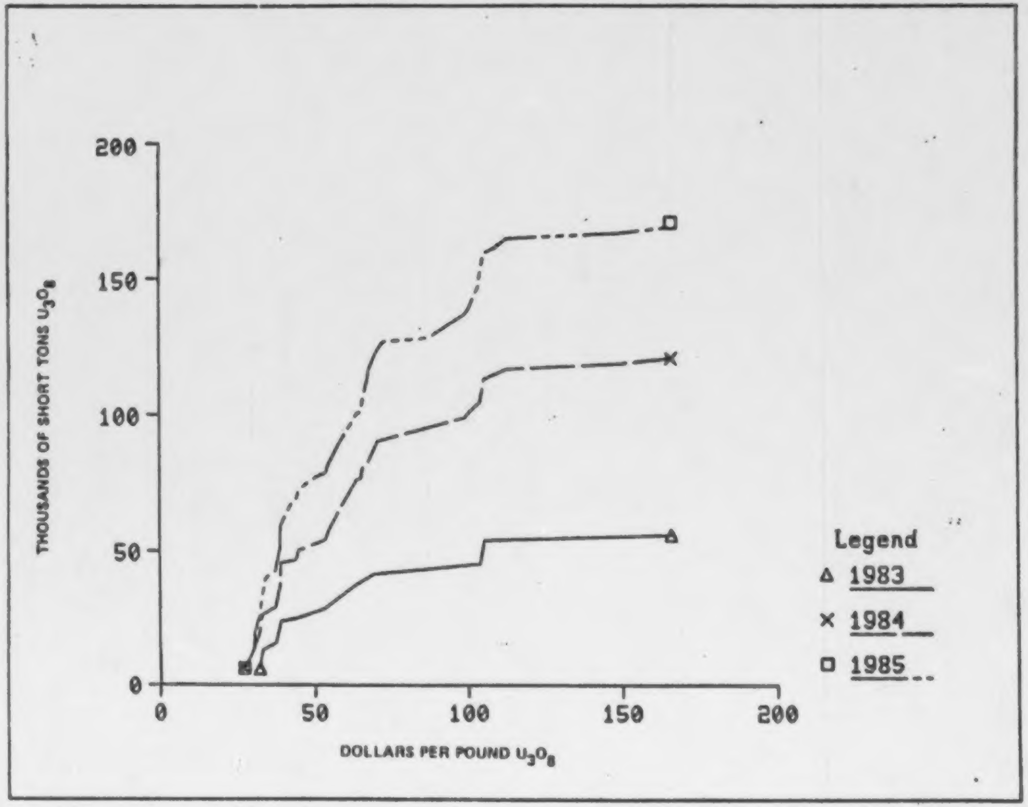

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FIGURE 3.5 INCREMENTAL URANIUM PRODUCTION AT BREAKEVEN PRICES (CONSTANT 1981$)

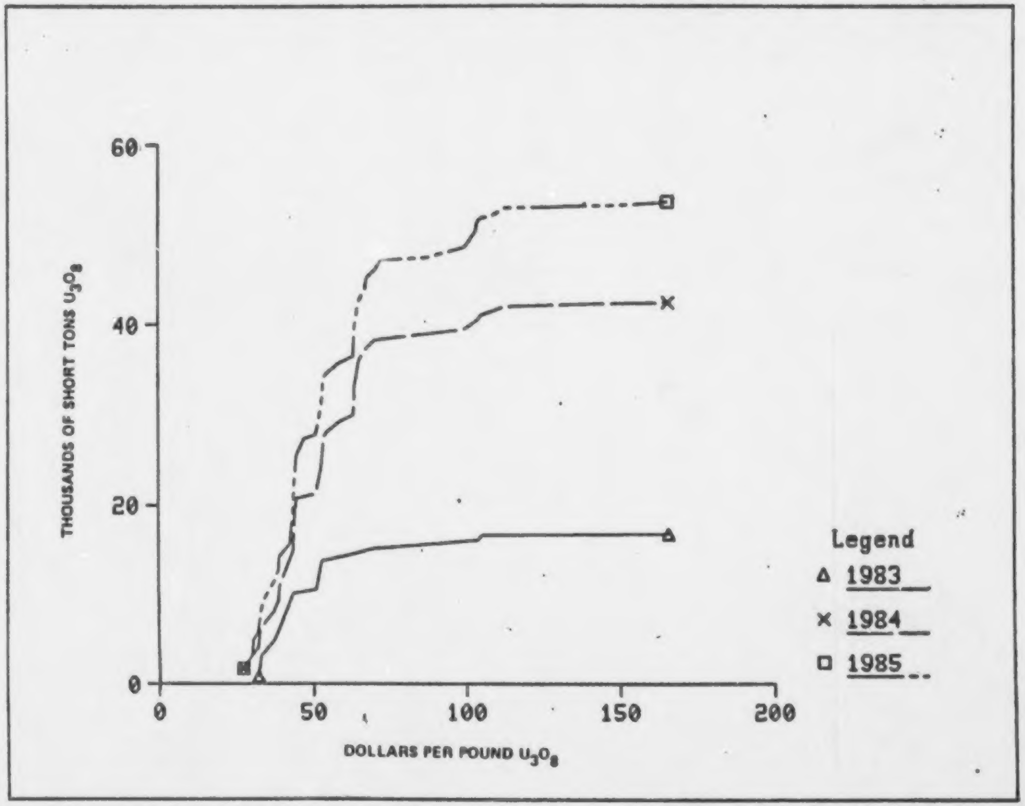

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FIGURE 3.6 RANGE OF FLOOR PRICES OF MARKET PRICE CONTRACTS AS OF JANUARY 1, 1981

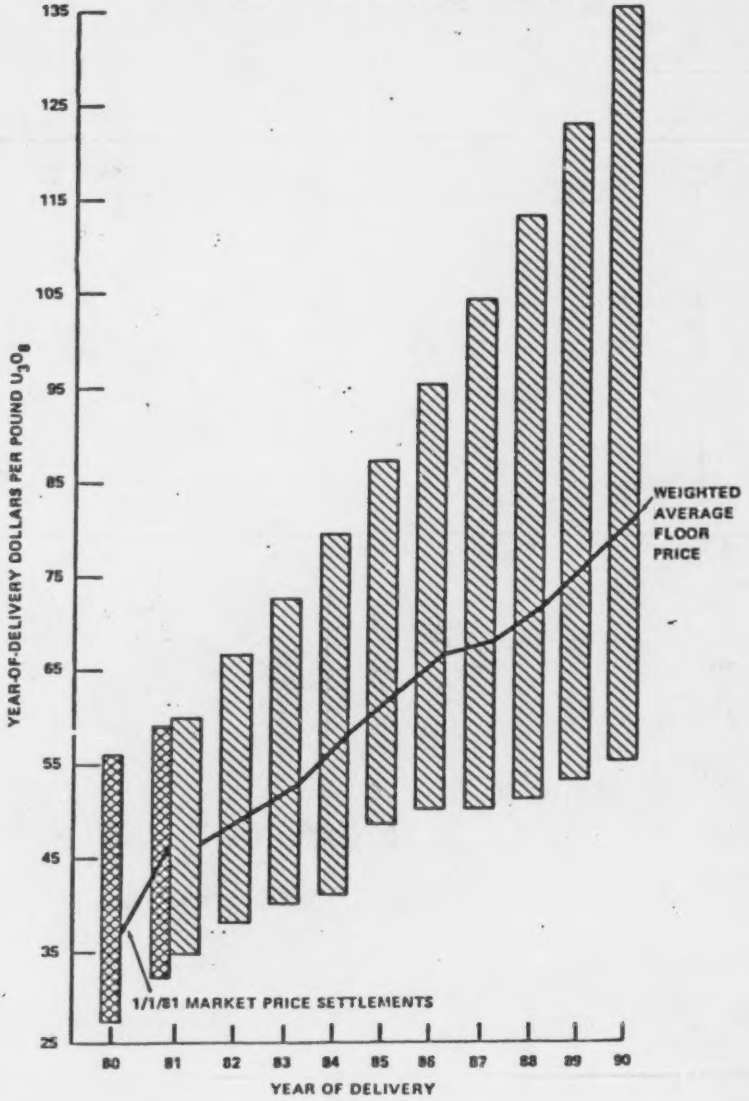

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Figure 3.7 Status of the Domestic Uranium Market

As of January 1, 1981

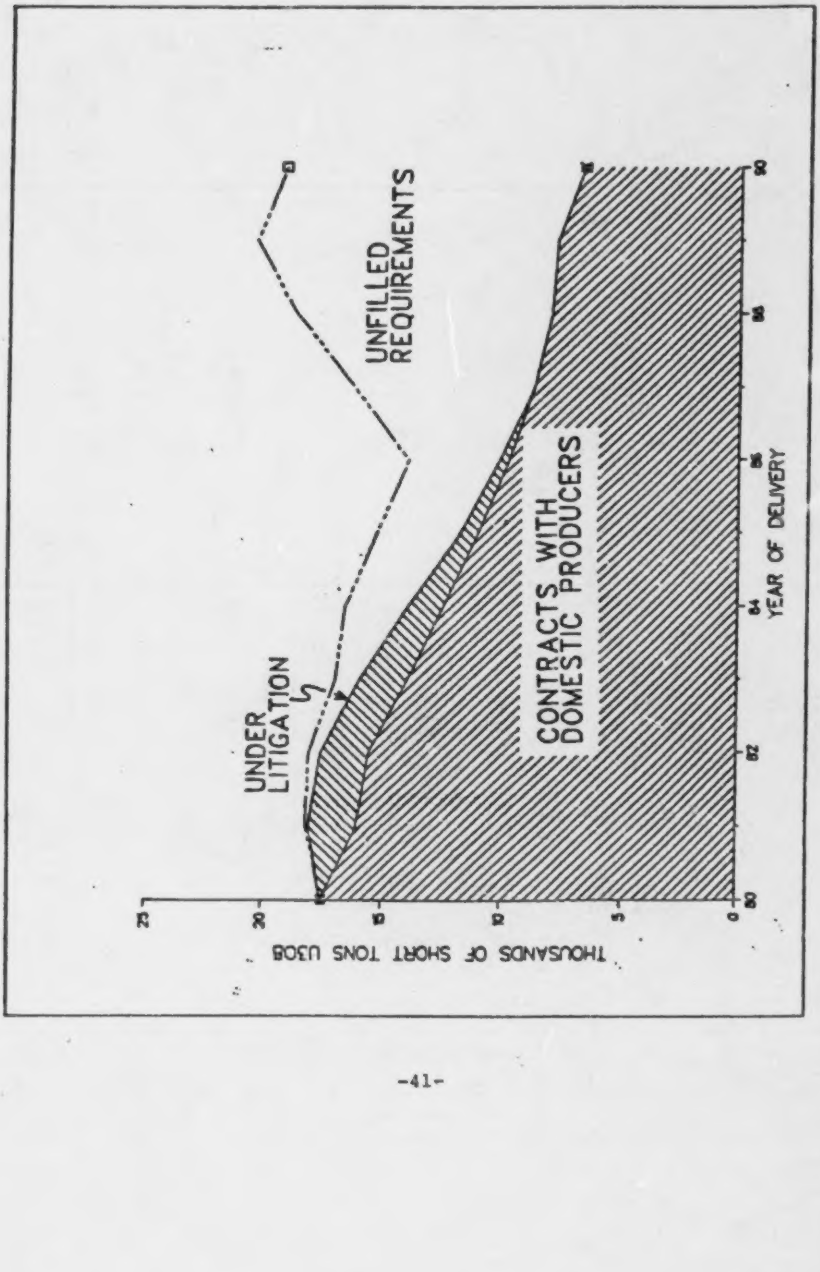

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FIGURE 3.8 SUPPLY - DEMAND CLEARING CONCEPT

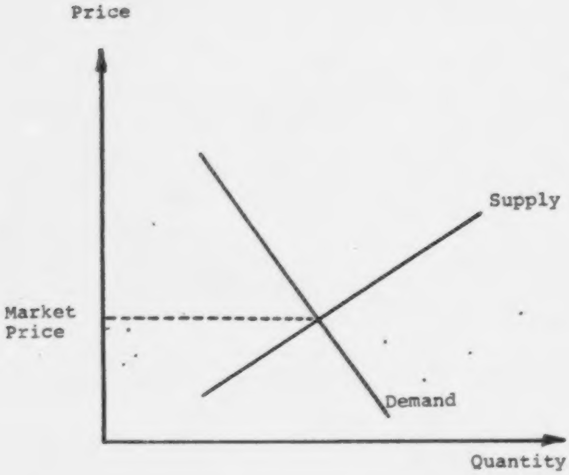

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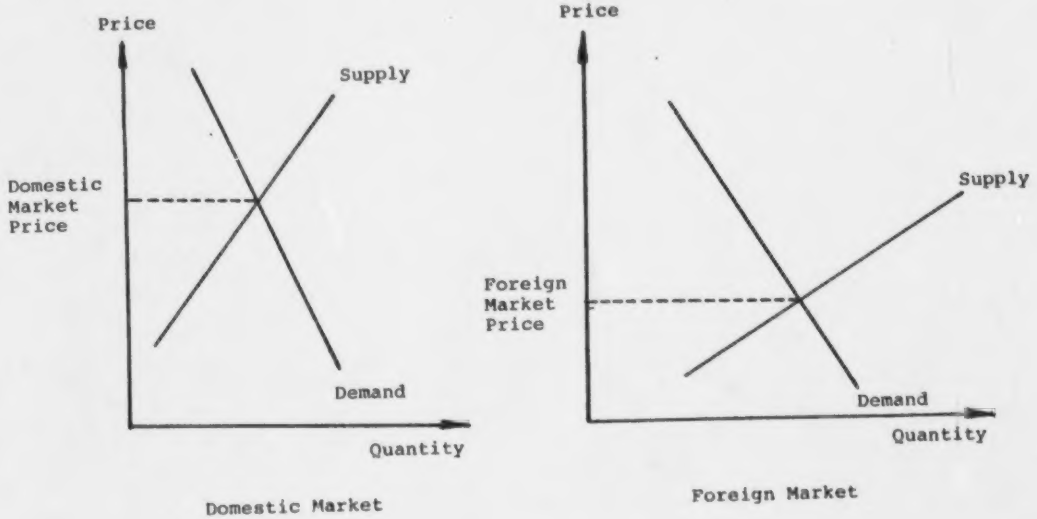
FIGURE 3.9 ISOLATED MARKETS - NO INTERNATIONAL TRADE



Domestic Market

Foreign Market

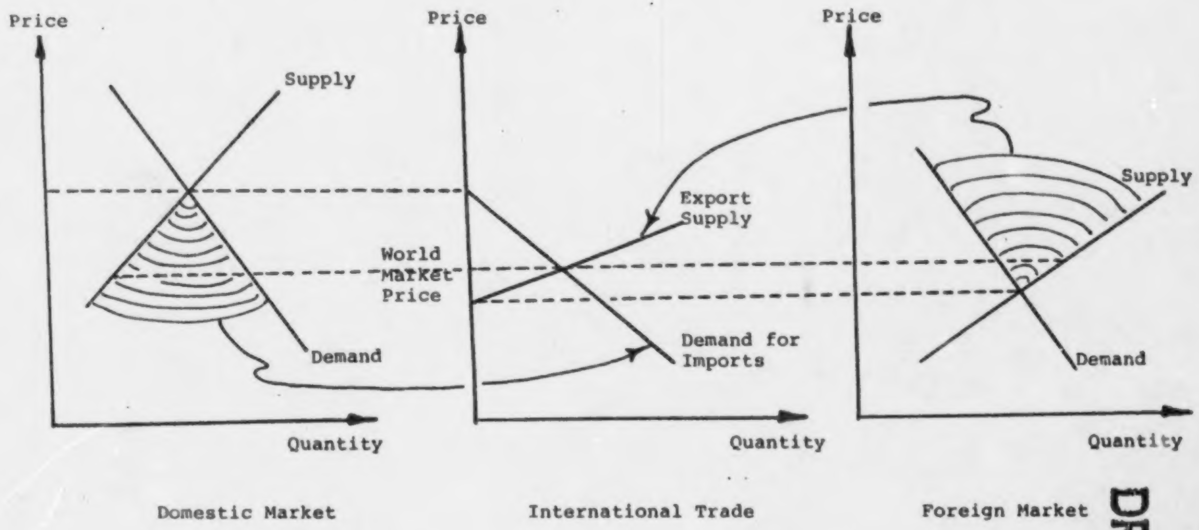


FIGURE 3.10 UNRESTRICTED INTERNATIONAL TRADE

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FIGURE 3.11 IMPORT CEILING

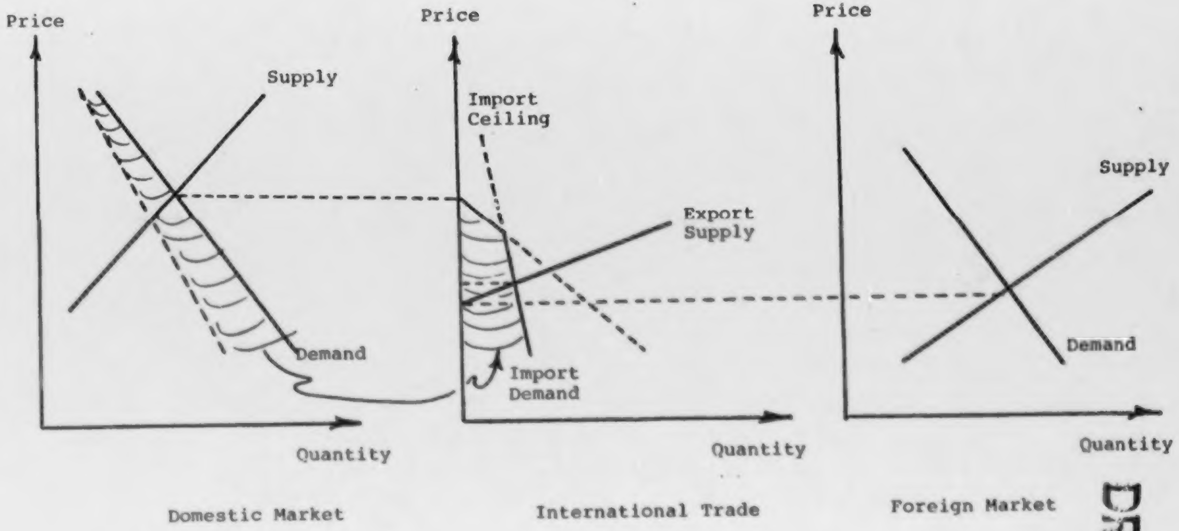

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FIGURE 3.12 IMPORT TARIFF

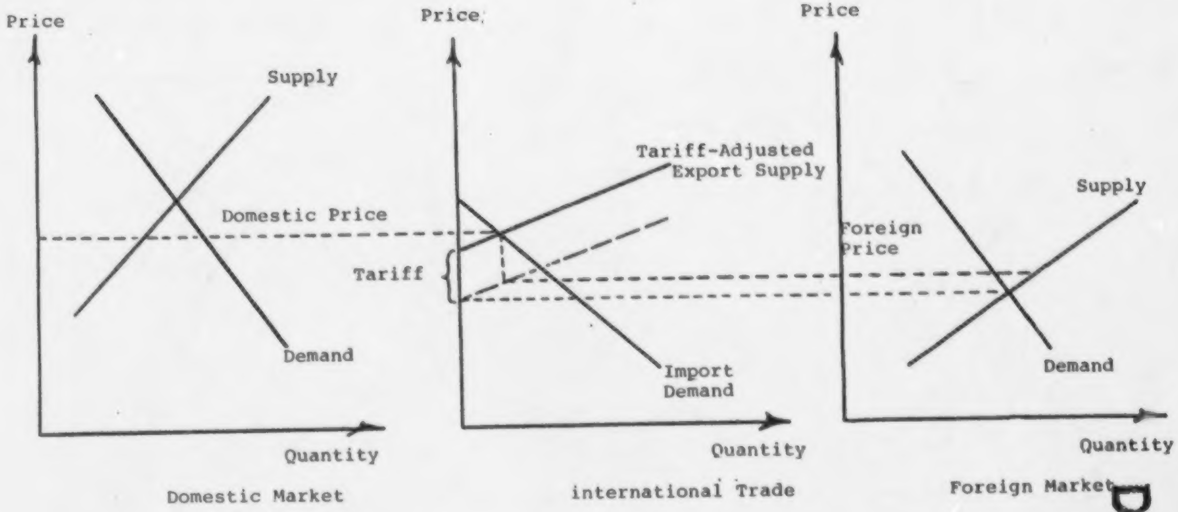

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FIGURE 3.13 ENRICHMENT TRANSACTION CHANGE

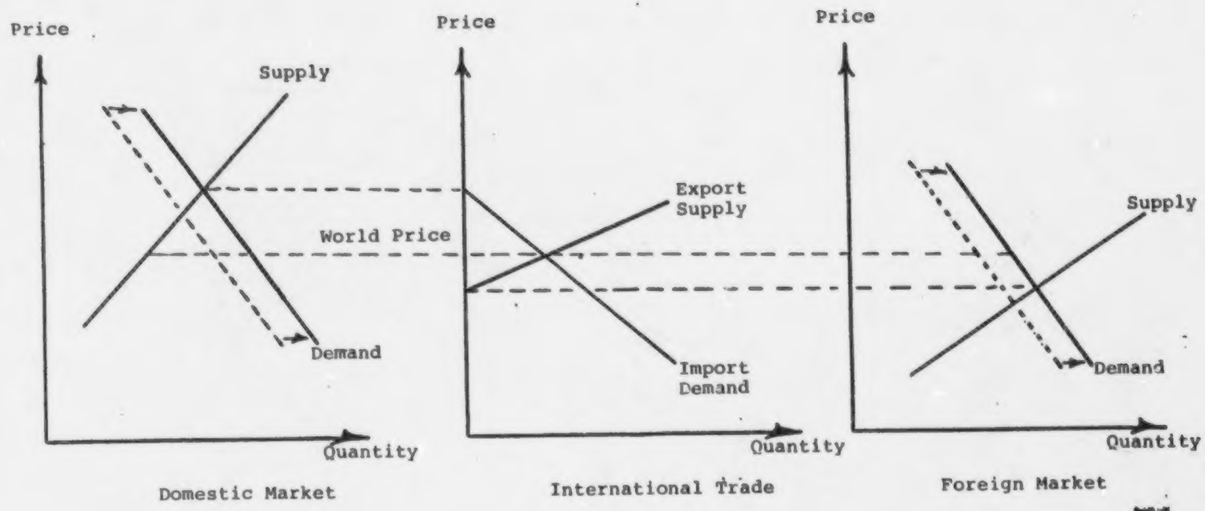
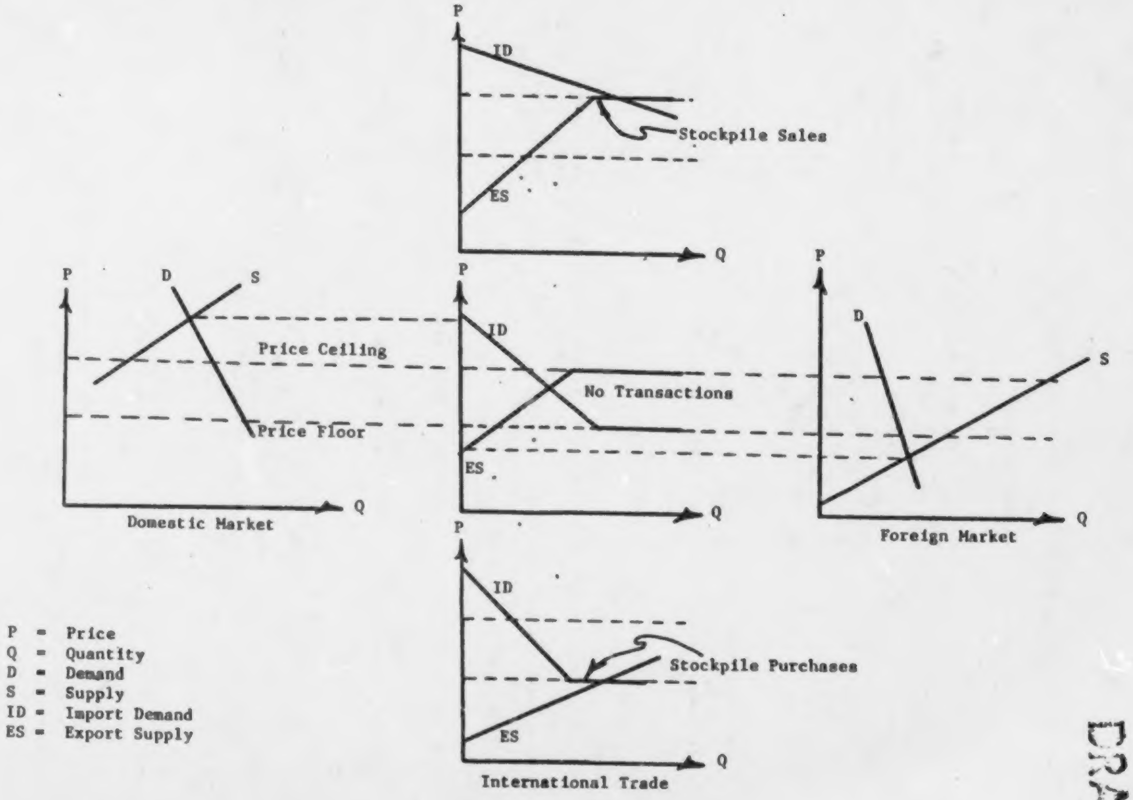


FIGURE 3.14 INTERNATIONAL COMMODITY AGREEMENT



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4. THE URANIUM MARKET UNDER THE CURRENT IMPORT POLICY

Background

The current Federal policy for controlling imports of uranium is implemented through the Department of Energy's (DOE) program for providing enrichment services. Uranium enrichment services are provided on a toll basis; that is, the customer delivers the required natural (unenriched) uranium feed material to the DOE enrichment facilities. DOE then provides the enriching services (for a fee), returning enriched material to the customer. This service is a Federal monopoly in this country, although there are other enrichment suppliers overseas.

This monopoly enables the Federal Government to control imports of uranium in an indirect manner -- by qualifying the terms under which enrichment services are provided to domestic customers.

Major Assumptions

The present policy for uranium import controls is manifested as a schedule of upper limits on the fraction of a domestic omers's feed material (that can be of foreign origin) to DOE ichment plants. This schedule, shown in Table 4.1, provides for no limitation after 1983.

The "base case," analyzed in this chapter, assumes continuation of the current policy and provides a background against which to consider the other policy options. Even with a clearly defined policy, uncertainity in other areas might preclude accurate forecasts of uranium market activities. As was noted in Chapter 3, there appears to be an almost-certain inadvertent buildup of buyer inventories over the next several years. One major uncertainty is, then, the manner in which inventory holders will dispose of their excess and the impact of these large inventory levels on price. The analysis reported here incorporates a range of assumptions about the accessibility of the market place to excess inventories.

A third major assumption is the pattern of future uranium demand. "Demand" in this analysis system is defined to be the requirement (through enrichment contract terms) for delivery of uranium to the DOE enrichment complex, with a 3 month lead time for processing into uranium hexafluoride. The numerical assumptions for demand are based on current schedules for deliveries to the DOE enrichment complex. The expected future demand in a given

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year, and thus the demand for uranium in the market place, is determined from the DOE market survey, as shown in Chapter 3. It therefore incorporates utility plans to draw down excess inventories. The demand schedule is shown in Figure 4.1.

The major non-policy assumptions (which are uniform for all the alternative policy cases) are summarized in the Appendix.

Results

The projected features of the uranium market, which form the characterization for future comparisons, are illustrated in Figures 4.2 through 4.4. Shown are historical data from 1960-1980 of the projections beyond 1980 for the various market parameters: one (variation A), assuming current utility import policy restraints at the 35-percent level; two (variation B), assuming complete indifference of utilities toward foreign _versus_ domestic uranium suppliers. A band of values corresponding to the standard deviation of the 30 cases for the option is shown for each variation.

A general characterization of this current policy option follows:

1. The market price for uranium remains almost level (variation B) or steadily rising (variation A) in constant-dollar terms through the mid-1980's under the influence of continued excess supplies (including inventories). There is a general trend of increasing prices after a dip in the period around 1990. By the year 2000, variation A displays a price of $80 per pound and variation B displays a price of $55 per pound.

2. The market price for new contracts is too low to encourage expansion of domestic production capacity. Domestic productions in fact, declines precipitously to a level of about 50 percent of recent production, by 1986. For variation A, a steady incline begins after 1986 so that 20 thousand tons of production occurs by the year 2000. For variation B, on the other hand, the decline in domestic annual production continues to drop to a level below 5 thousand tons in the early 1990's, but recovering to a level of 10 thousand tons by the end of the century.

3. Import levels remain low until the mid-1980's, after which large supplies of relatively low-cost

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foreign uranium penetrate the domestic market. On the low side (variation A), imports increase to a level of 10 thousand tons per year in the year 2000. On the high side (variation B), imports increase rapidly after the mid-1980's, leveling off at 20 thousand tons per year. Thus imports capture a third to two-thirds of the domestic market by the year 2000.

Comparison to Other Studies

There are two recent reports that provide an opportunity for comparison with these results. The first report, *Intermediate Term Uranium Supply Curve Estimation* (Report EA-1706, published by the Electric Power Research Institute, EPRI, in February 1981), provides estimates of domestic production capacity through 2000. The variation B correlates well with the EPRI "firm production" estimates by the year 1990, but the EPRI total production estimate exceeds 20 thousand tons per year by 1990, well above the level of 17 thousand tons for the variation A.

The second comparison is between the EIA cases and the uranium supply/demand estimates of the Nuclear Exchange Corporation (NUEXCO), published in "Uranium: A Market in Transition," June 1981. The NUEXCO demand assumption is lower than EIA's. EIA projects imports to be in the range of 6-17 thousand tons in 1990, compared to NUEXCO's value of 12 thousand tons. The NUEXCO domestic production projection is very similar to the EIA variation B.

The NUEXCO uranium demand estimates assume lower average operating factors for nuclear powerplants than the EIA estimates -- 55 percent *vs*. 65 percent -- and also assume improvements in the efficiency of uranium utilization which are not assumed in the EIA estimates. In addition, NUEXCO assumes a very pessimistic outlook for U.S. nuclear power growth, as shown in Table 4.2. Their 112 gigawatts of domestic nuclear power capacity online in the year 1990 is well below the EIA low case of 123 gigawatts. There are currently 129 gigawatts of domestic capacity online or greater than 10 percent constructed; thus, the 112 gigawatt assumption is very pessimistic.

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Table 8.1 Current Schedule for Import Controls

Year	Maximum Fraction of Foreign-Origin Uranium Feed
Prior to 1977	0.0
1977	0.10
1978	0.15
1979	0.20
1980	0.30
1981	0.40
1982	0.60
1983	0.80
After 1983	1.00

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Table 4.2 Midterm Nuclear Power Capacity in Commercial Operation: Comparison of Forecasts, 1985-95
(Gigawatts at Yearend)

Source	1985	1990	1995
1980 Annual Report	86-102	123-136	135-155
1979 Annual Report	86-109	121-139	137-160
1978 Annual Report	102-119	142-171	186-225
DOE Utility Survey (October 1980)	107	161	173
Data Resources Inc. (Autumn 1980)	96	130	160
Exxon[a] (December 1980)	NA	120	NA
National Electric Reliability Council (July 1979)	134	NA	NA
Nuclear Regulatory Commission[b]	98	136	154
Westinghouse Corporation (March 1980)	103	142	192
Babcock & Wilcox, McDermott Corp. (March 1980)	105	133	137
Nuexco (November 1980)	79	112	

[a] Exxon Company, U.S.A., Energy Outlook 1980-2000, December 1980.

[b] "NRC Caseload -- Planning Projections for Fiscal Years 1982-86," U.S. Nuclear Regulatory Commission, March 1980.
NA = Not Available.

Source: Annual Report to Congress for 1980; Volume Three: Forecasts Report DOE/EIA-0173(80)13, (U.S. Energy Information Administration, Washington, D.C., April 1981).

FIGURE 4.1 CURRENT POLICY CASE: DEMAND

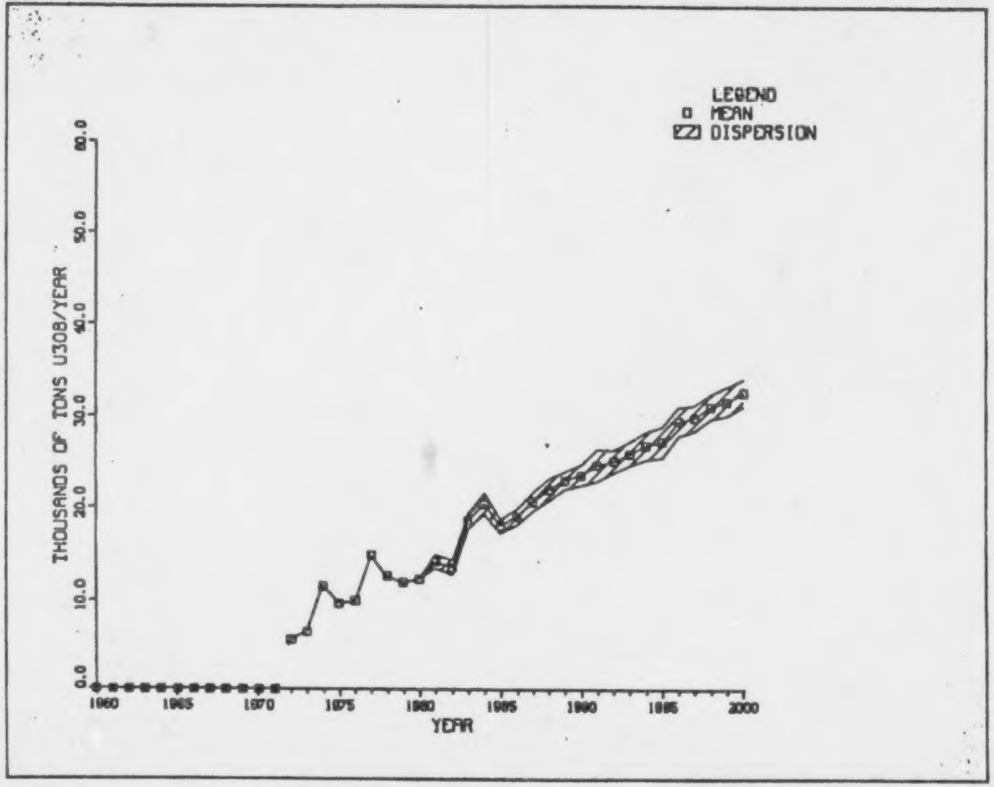

FIGURE 4.2A CURRENT POLICY CASE: MARKET PRICE, VARIATION A

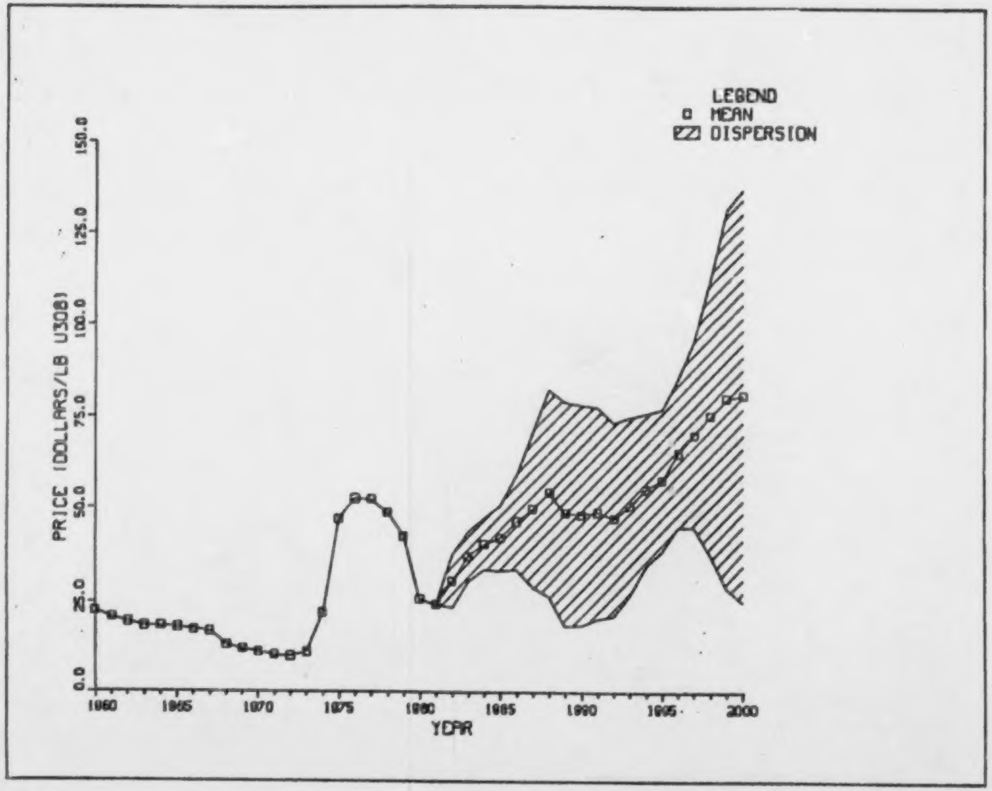

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FIGURE 4.2B CURRENT POLICY CASE: MARKET PRICE, VARIATION B

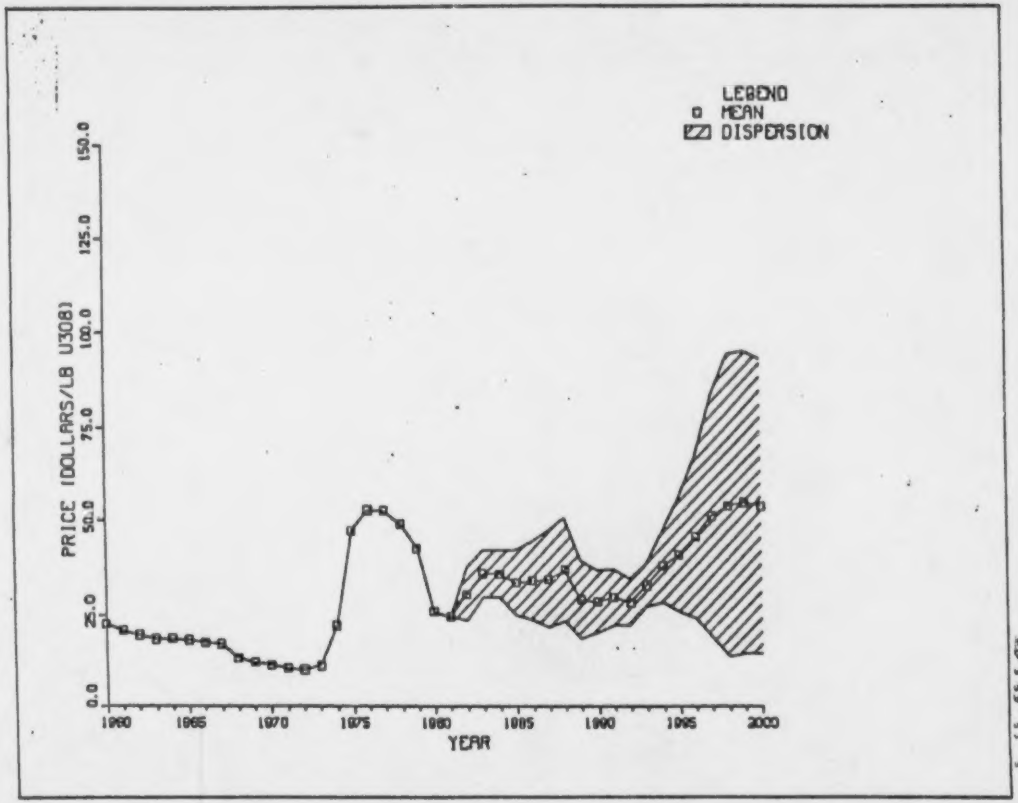


Figure 4.3A Current Policy Case: Domestic Production, Variation A

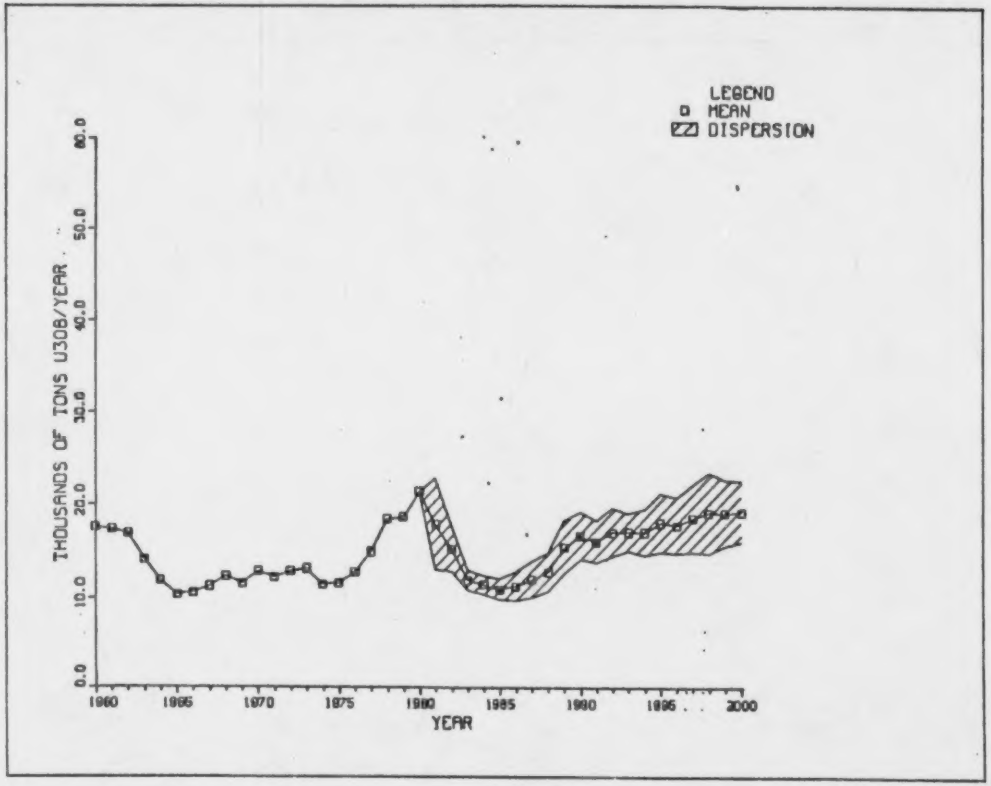


FIGURE 4.3B CURRENT POLICY CASE: DOMESTIC PRODUCTION, VARIATION B

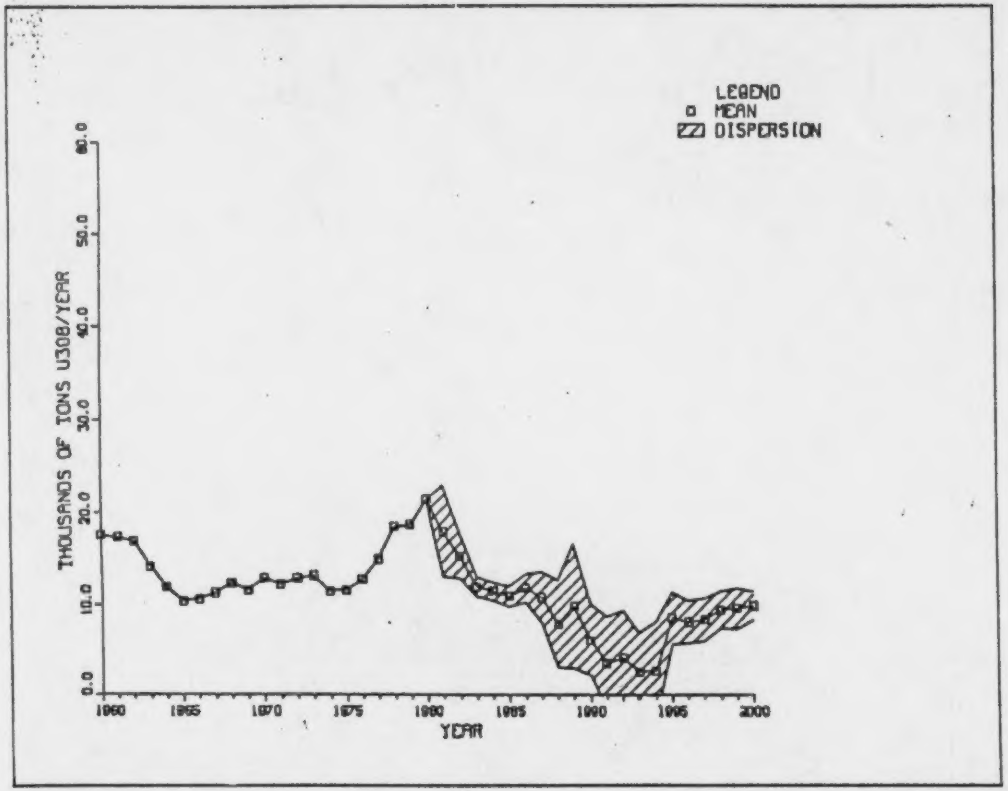
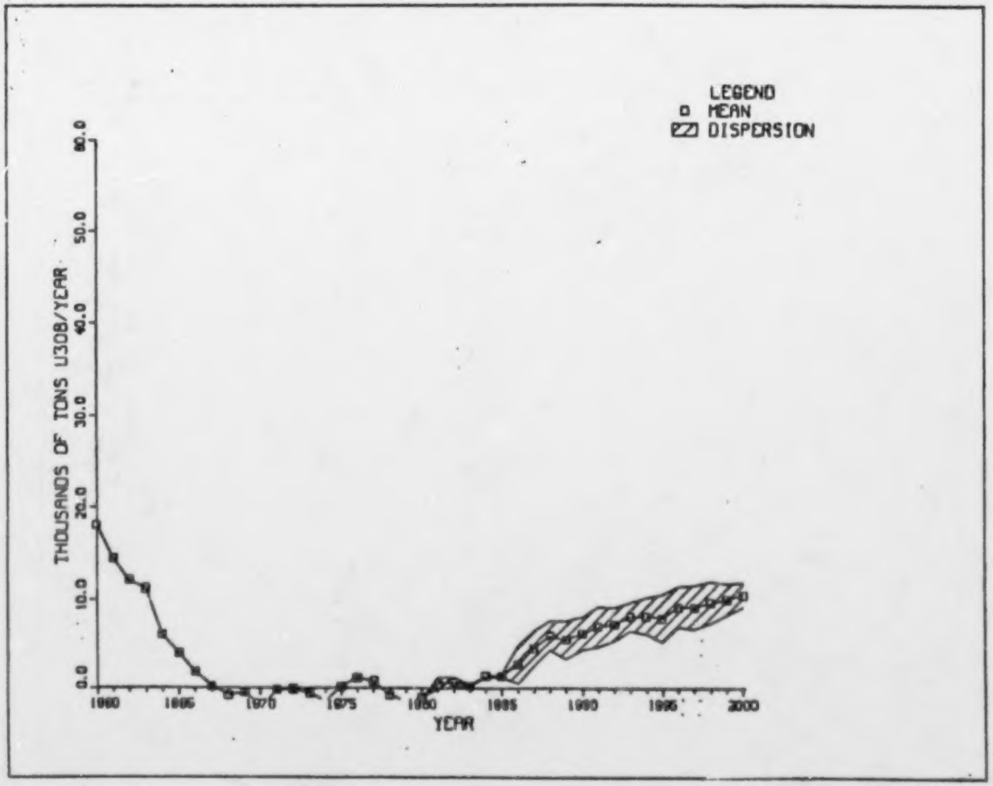


FIGURE 4.4A CURRENT POLICY CASE: IMPORTS, VARIATION A



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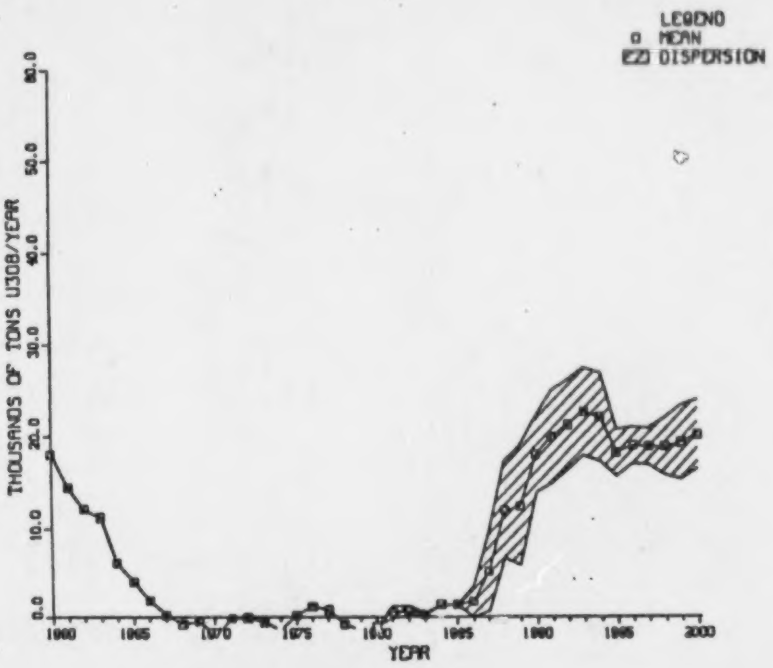

FIGURE 4.4B CURRENT POLICY CASE: IMPORTS, VARIATION B

5. THE EMBARGO OPTIONS

Two different modifications of the existing Federal policy for controlling imports of uranium are examined in this chapter, namely the "Deferred Embargo Phaseout" and "Import Ceilings".

Deferred Embargo Phaseout

This policy, put forth in the earlier DOE report, proposes a freeze on the lifting of the embargo restrictions until some future time when conditions would warrant the embargo removal. Senator Domenici requested an analysis of a import limits freeze at the 30-percent level for 5 years or until conditions warrant a return to the annual incremental decrease of import restrictions under the current policy. The implementation of the "Deferred Embargo Removal" policy would be initiated by an announcement in late 1981 that beginning in 1982 the enrichment of imported uranium (for domestic customers) is limited to the 30-percent level indefinitely. Thus, buyers' procurement practices are tempered by this indefinite policy. Later, assuming that conditions warrant a return to the current policy, a decision is made in 1985 to resume the annual increments in maximum allowable percentage of foreign uranium under current policy schedule, beginning in 1987 with a 40-percent level. It is also assumed that import contracts already in place in 1981 are exempt from this restriction. The assumed schedule for this policy is summarized in Table 5.1.

The examination of uranium market price, levels of domestic production and the imports projected under the "Deferred Embargo Policy" shows clearly that the desired effects are not achieved. The domestic industry is protected from imports over a period of time in which protection is not needed and lifting the protective shield after 5 years is done at the critical period when some kind of protection could ameliorate a potential influx of imports.

The projections of maximum market price, domestic production and imports under this policy are illustrated in Figure 5.1 through 5-3. When these projections are compared with those under the current policy, one can see that the few thousand tons per year of uncontracted demand for uranium in the years following the initiation of the policy (1982-1984) displaces the market price slightly upward ($5 per pound) but has almost no impact on domestic production levels. The return to the current schedule for import controls in 1987, coupled with a more rapid inventory

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drawn down and a higher influx of imports (about 5000 tons of uranium concentrate per year more in 1991 than under the current policy) results in lowering the market price in 1990 to the 1981 level, and depressing the domestic production almost to a very low level in early 1990's. The upturn in demand for uranium in the mid 1990's brings the domestic production to the same level as it would have been under the current policy.

Import Ceilings

A second category of import control changes examined under the embargo options is that of a ceiling on the fraction of foreign-origin uranium feed material for domestic enrichment customers. Three different levels of control are considered: 20 percent, 30 percent, and 40 percent ceilings on the import fraction for each domestic enrichment customer. The 40 percent policy option can also be modified by considering the impact of domestic utilities' current behavior which limits foreign supports of uranium to about 35 percent of the total. This assumption leads, in effect, to a 35 percent import ceiling option.

Not surprisingly, the different fractional limits have qualitatively similar effects; the major differences are merely in the magnitude of the effects.

The projections of uranium market prices, domestic production and imports for the 40 percent import ceiling policy option are given in Figures 5.4 through 5.6. The projections of these variables for all three indefinite control options are then compared with the projections for the current policy case and the differences in market price, domestic production and imports are presented in Figures 5.7 through 5.9.

The close examination of results reveals that the implementation of any one of these policies would not result in a significant change in domestic production or net imports over the next 6 years. However, the market price could be affected noticeably as early as 1984. This early effect is due to the removal of part of the lower-cost foreign supply from the long-term market and the lengthy lead time for long-term contracts. The market price path is estimated to shift upward by typically $15, $25, and $50 per pound in the 1990's for the 40-, 30-, and 20-percent limits, respectively, compared to the variation B of the current policy option. The shifts, compared to variation A, are $0, $5, and $30, respectively.

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The domestic production which is estimated to be almost unchanged from the current-policy case through the mid-1980's for all import ceiling policy variations would tend to rise in late 1980's and early 1990's in concert with its share of domestic requirements. The more stringent the control, the stronger is the surge in domestic production capacity in 1990's. Its growth rate would gradually stabilize and by the turn of the century, the level of domestic production would range from 18 thousand tons annually for the 40 percent import limit policy option to 25 thousand tons annually for the 20 percent limit option. The import results for these policy options are not presented here, as utilities are expected to adjust their procurement policies to the notable increases in market price and to take a full advantage of maximum allowable percentage for foreign supplies.

It is clear that the effect is one of isolating the United States from the world market, so that the market price under 20 percent import controls reaches $125 per pound in constant 1990 dollars by the end of the century. Thus, it is the higher price that induces the higher domestic supply.

In all the import ceiling cases, net import levels are estimated to be at their maximum-permissible values during the entire period when import controls are in effect. As the utilities are restricted from increasing the share of their foreign supplies at will, the entire residual domestic requirement would have to be satisfied by increased domestic production.

Table 5.1 Assumed Schedule for Import Controls -- Defered Embargo Removal

Year	Maximum Fraction of Foreign-Origin Uranium Feed
Prior to 1977	0.0
1977	0.10
1978	0.15
1979	0.20
1980	0.30
1981	0.40
1982-1986	0.30
1987	0.40
1988	0.60
1989	0.80
After 1989	1.00

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FIGURE 5.1 DEFERRED EMBARGO REMOVAL: COMPARISON OF MARKET PRICE DIFFERENCES FOR POLICY OPTIONS

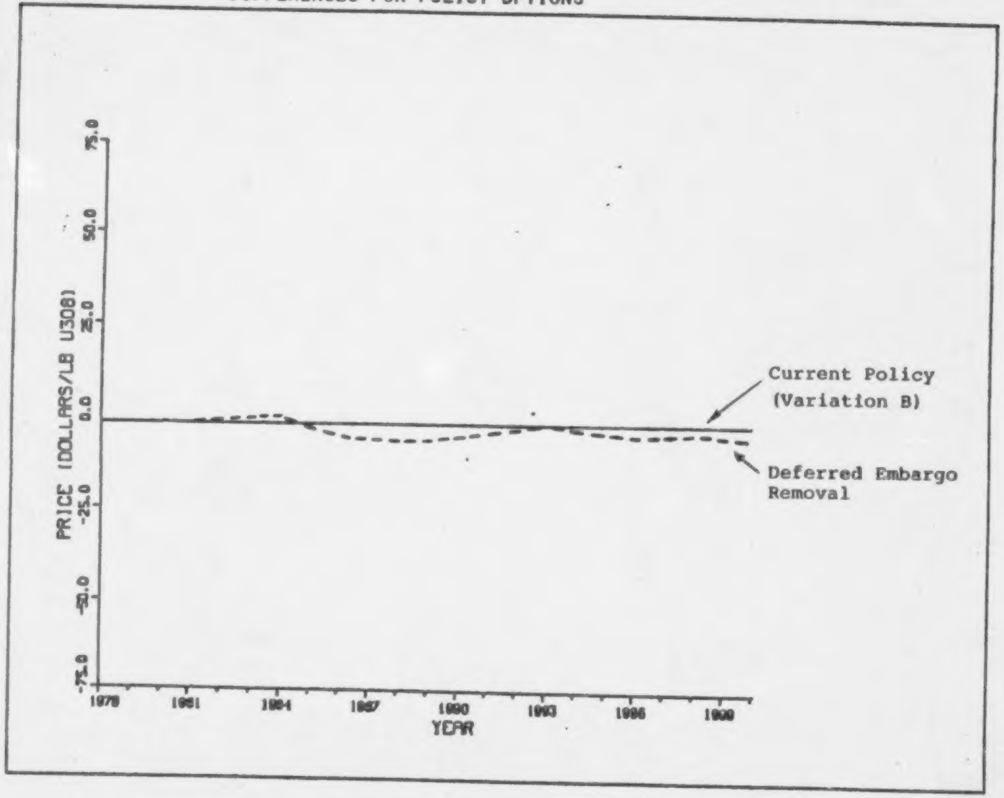

FIGURE 5.2 DEFERRED EMBARGO REMOVAL: COMPARISON OF DOMESTIC PRODUCTION DIFFERENCES FOR POLICY OPTIONS

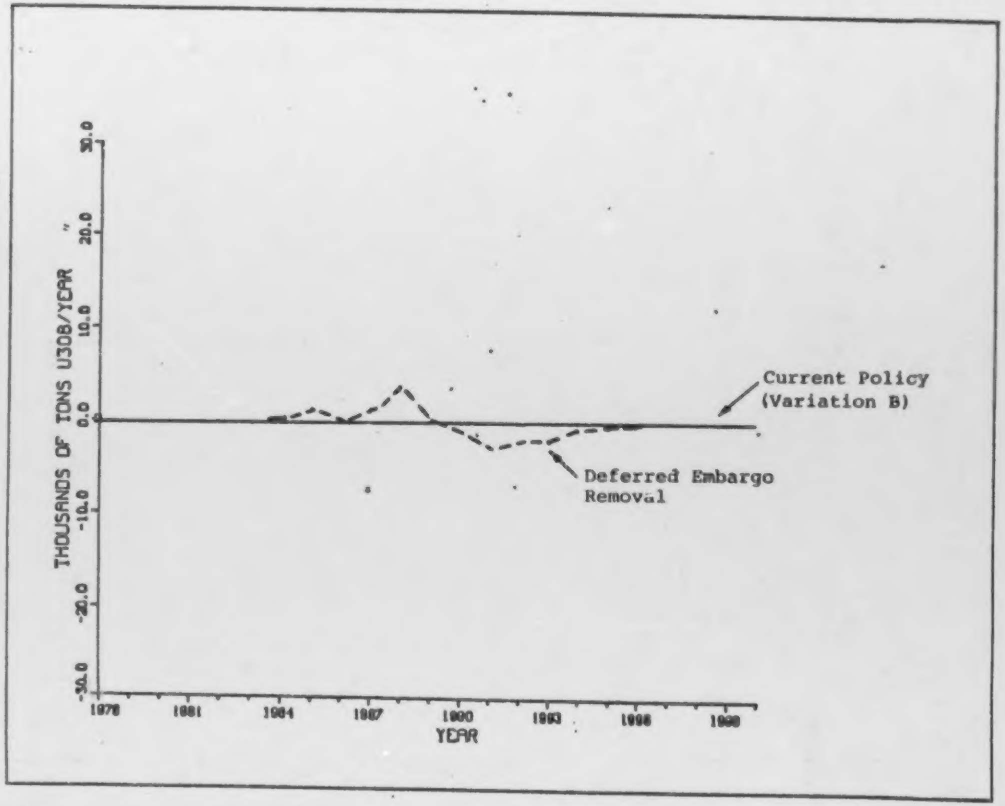

Figure 5.3 Deferred Emargo Removal: Comparison Of Import Differences For Policy Options

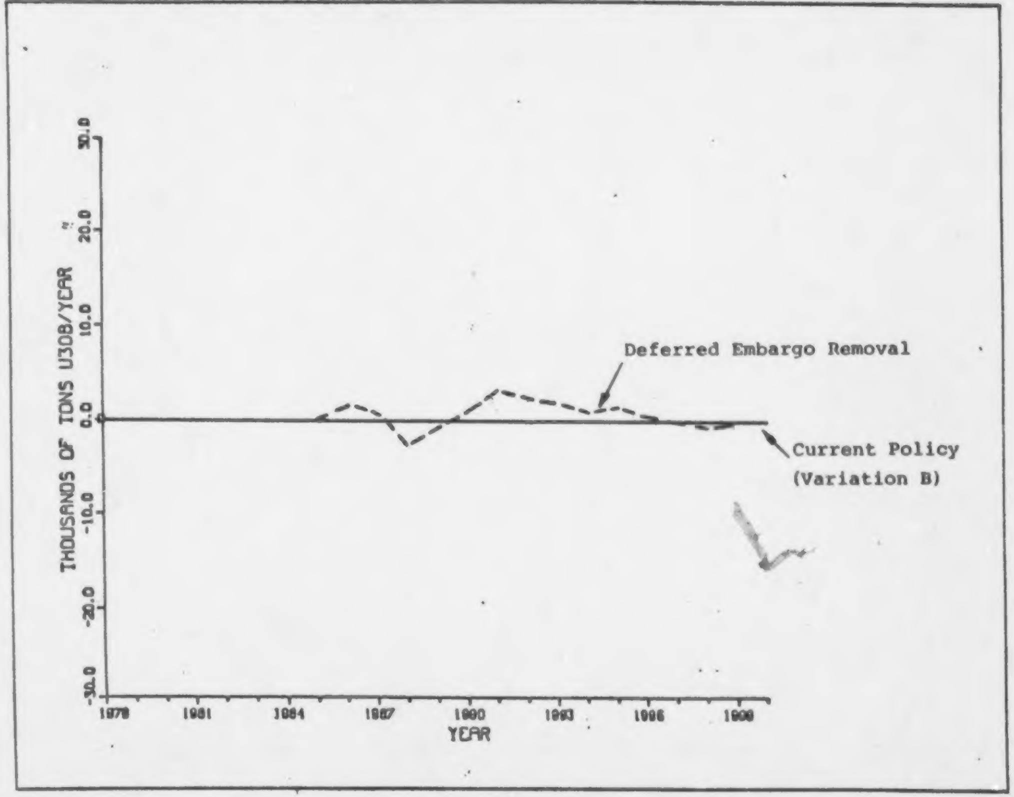

FIGURE 5.4 INDEFINITE CONTROLS - 40% LIMIT: MARKET PRICE

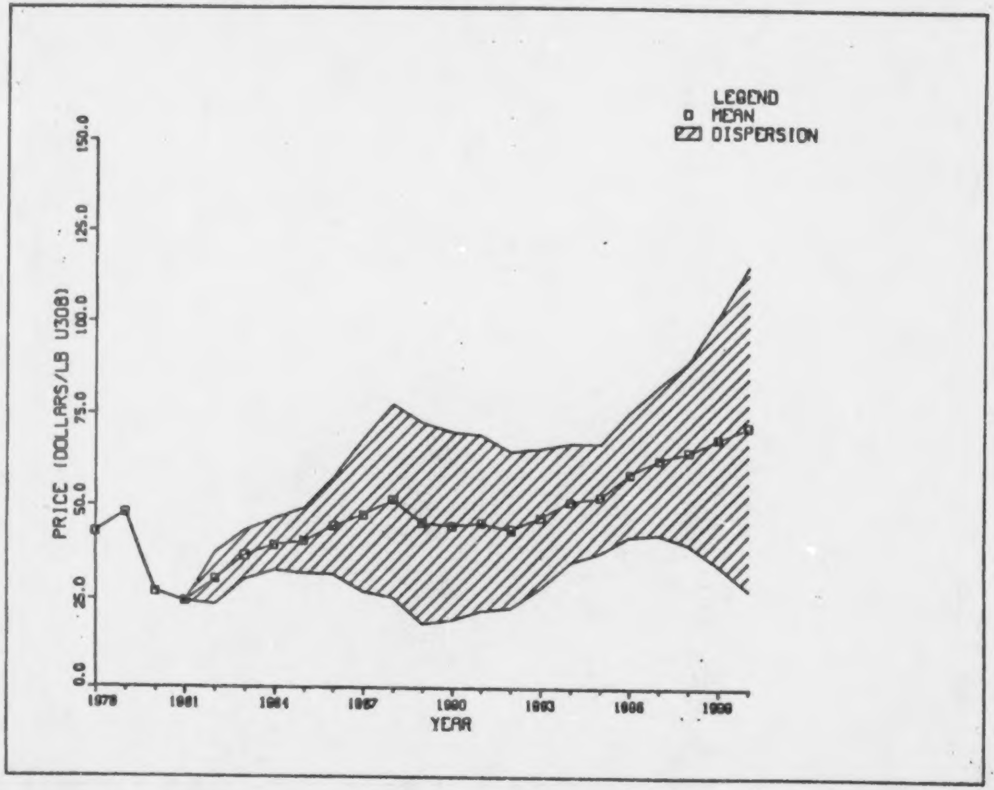

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FIGURE 5.5 INDEFINITE CONTROLS - 40% LIMIT: DOMESTIC PRODUCTION

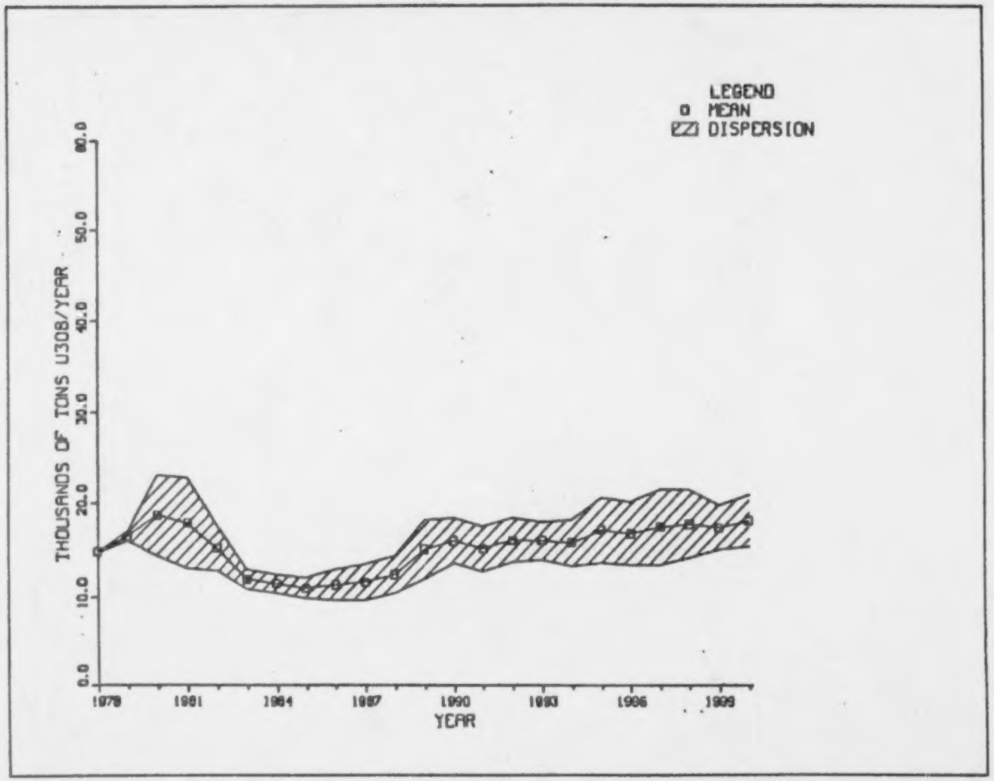

FIGURE 5.6 INDEFINITE CONTROLS - 40% LIMIT: IMPORTS

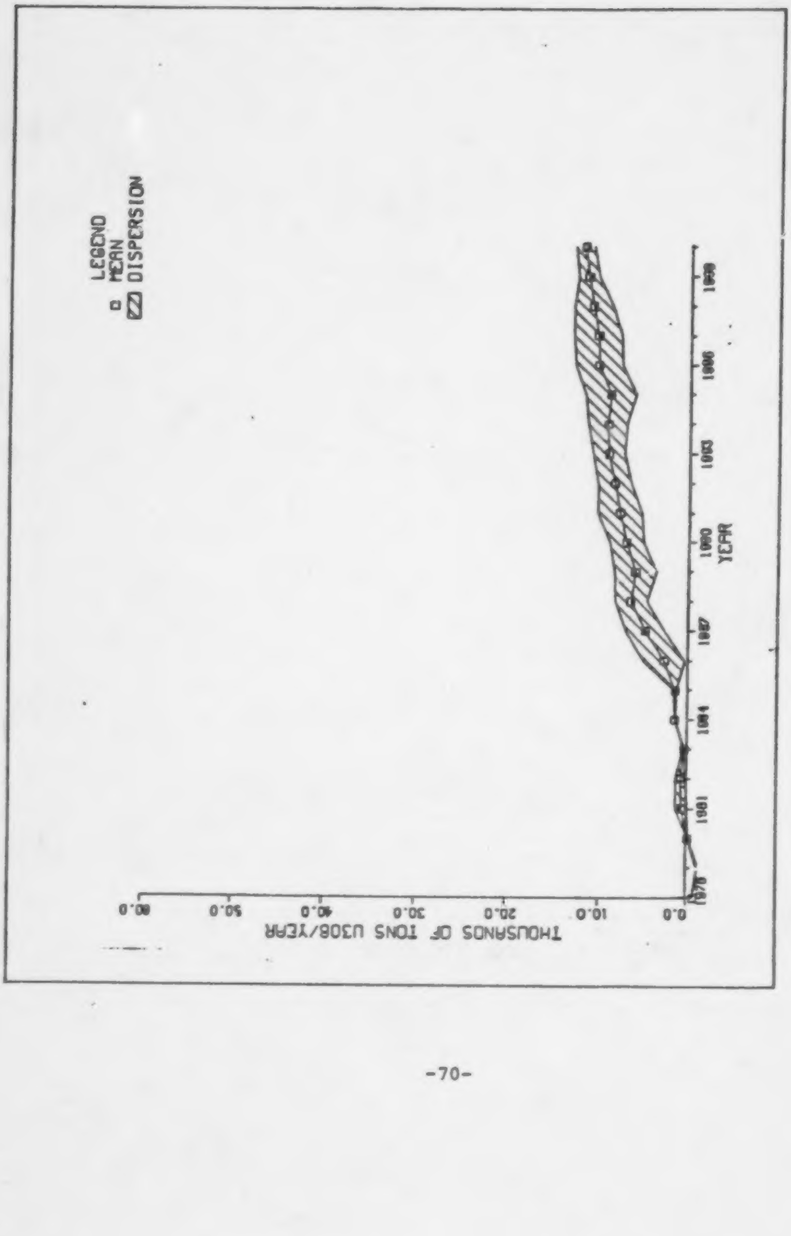

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FIGURE 5.7 INDEFINITE CONTROLS: COMPARISON OF MARKET PRICE DIFFERENCES FOR POLICY OPTIONS

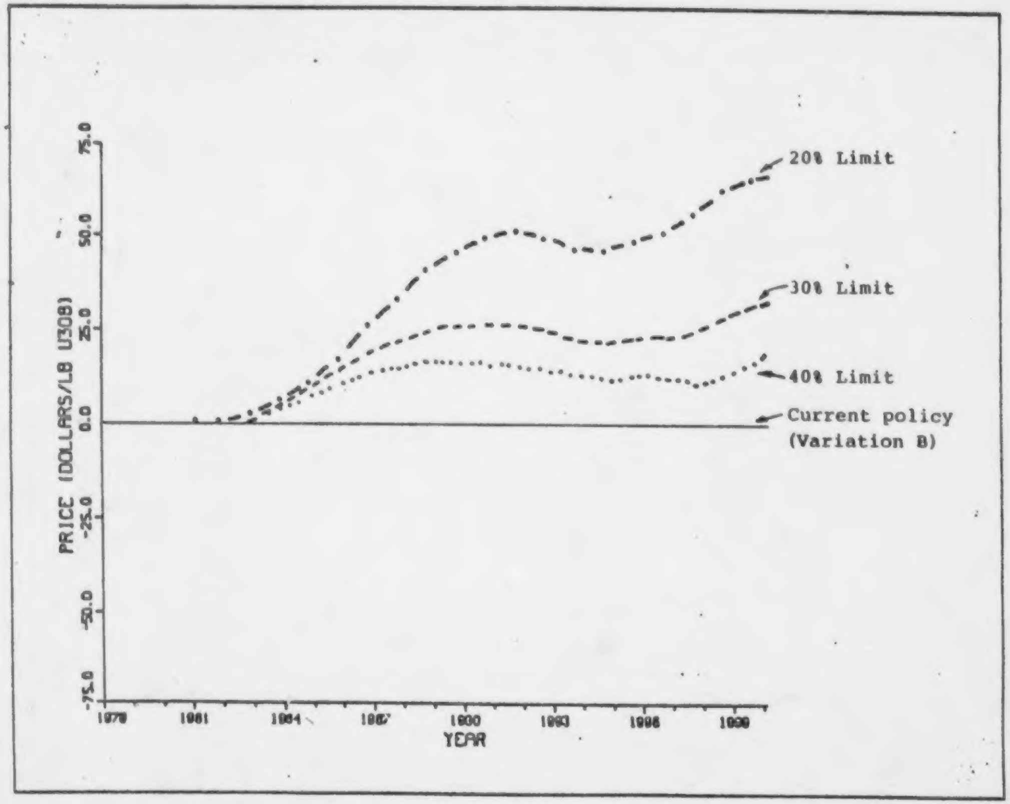

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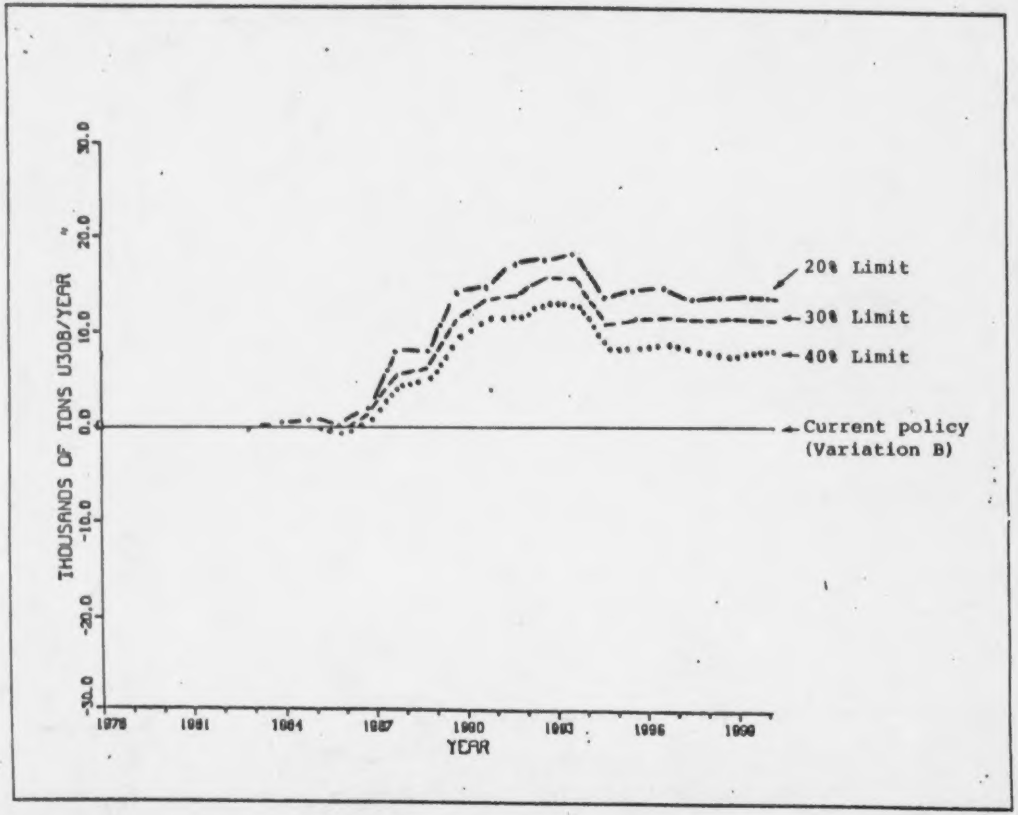
FIGURE 5.8 INDEFINITE CONTROLS: COMPARISON OF DOMESTIC PRODUCTION DIFFERENCES FOR POLICY OPTIONS



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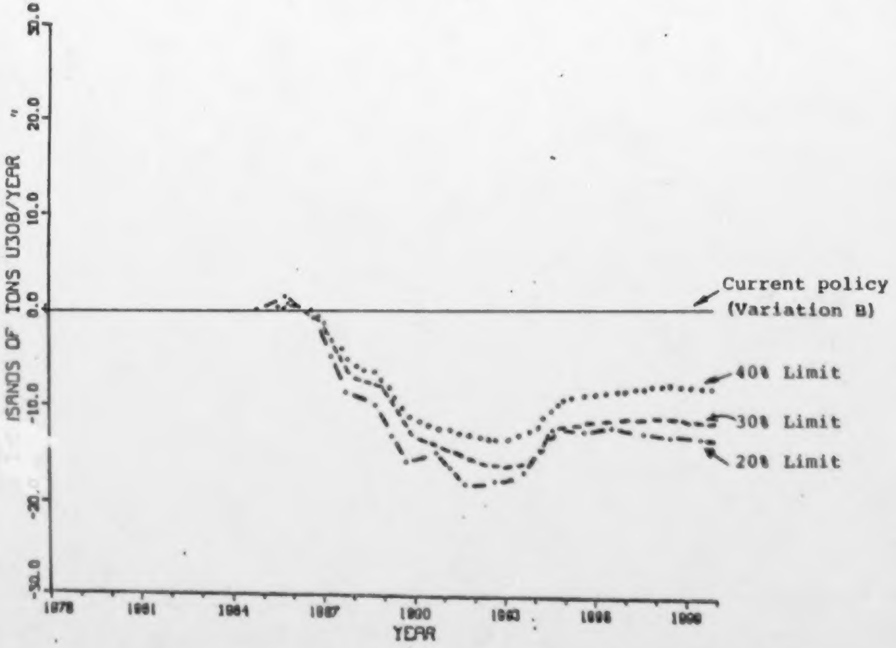

FIGURE 5.9 INDEFINITE CONTROLS: COMPARISON OF IMPORT DIFFERENCES FOR POLICY OPTIONS

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6. IMPORT TARIFFS

The imposition of tariffs has been traditionally the most common instrument of protection of domestic industries. A tariff causes the appearance of two prices, one being the price paid to the foreign country, the other is the price that the consumers (i.e. utilities) must pay. While the former price is generally lower than its pretariff equivalent, the latter is almost always higher. The discrepancy between the two prices comprises the import duty which accrues to the Government.

The higher domestic uranium price would ultimately result in higher costs of nuclear generated electricity. Domestic utilities in order to avoid tariffs may nevertheless purchase cheaper foreign uranium and also choose to use foreign enrichment services. This, in turn, would have negative impact on the DOE enrichment business. Thus, in order to protect also the U.S. enrichment interests, the tariff would have to be imposed on foreign uranium both in unenriched and enriched form.

In this analysis we examine the effects the imposition of a tariff on the foreign uranium would have on the domestic uranium prices, production and import levels. Two different import tariffs are considered, namely $5 and $10 per pound of uranium concentrate. The projections of uranium market prices, domestic production and imports for a $10-per-pound tariff are shown in Figures 6.1 through 6.3. A comparison of the impacts of both $5 and $10 tariff policies against the current policy case is presented in Figures 6.4 through 6.6. Again, this policy option is estimated not to impact domestic production before the late 1980's. In the mid-1980's, the impact on the market price, as paid by domestic consumers, could be about double the tariff level and would rise to about quadruple of the tariff level by late 1990's. After the projected decline in domestic production to an estimated 12 thousand annual tons in 1985, successively higher tariffs could protect the domestic industry and allow growth to 15 thousand annual tons in 1989 for a $10 per pound tariff, for example. However, after 1990 an estimated tariff of at least $20 per pound would be needed to assured that the domestic industry would grow in concert with domestic demand. The level of net imports, when compared to variation 3 of the current policy option, is decreased in late 1980's by about 5,000 tons and 12,000 tons annually for $5 and $10 tariff policies, respectively.

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FIGURE 6.1 IMPORT TARIFF OF $10: MARKET PRICE

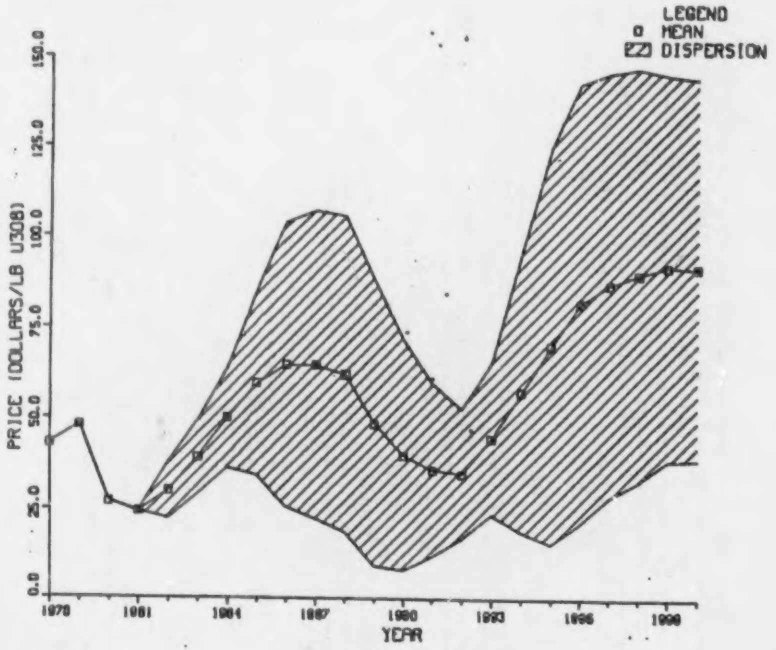

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FIGURE 6.2 IMPORT TARIFF OF $10: DOMESTIC PRODUCTION

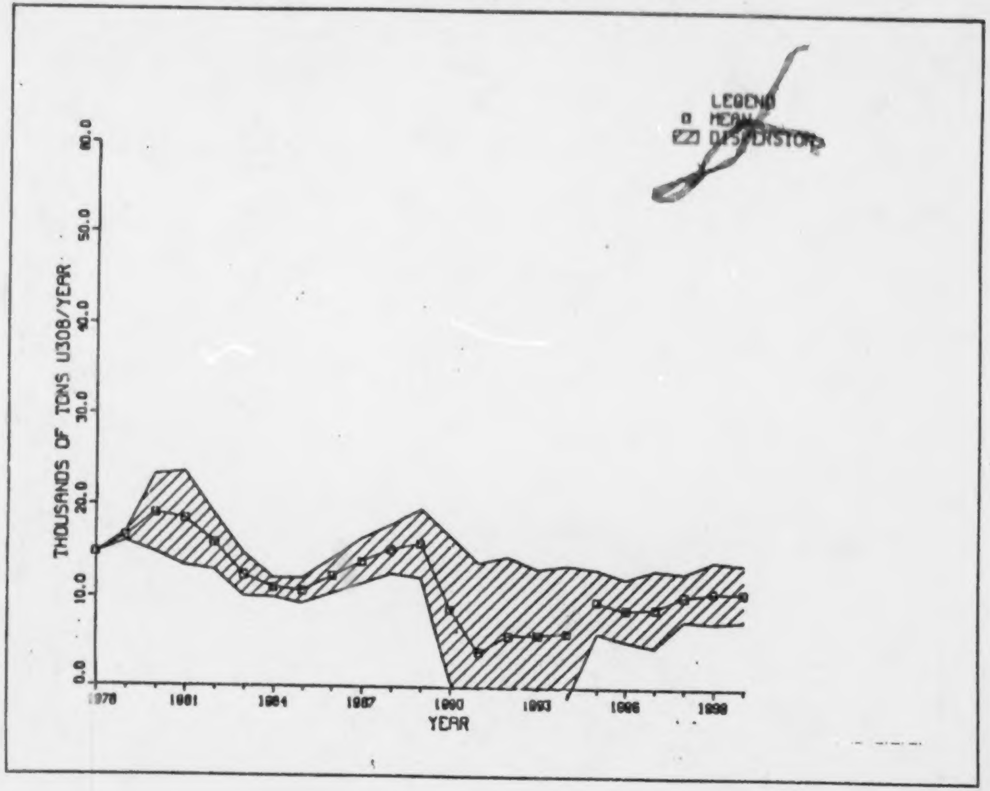

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Figure 6.3 Import Tariff of $10: Imports

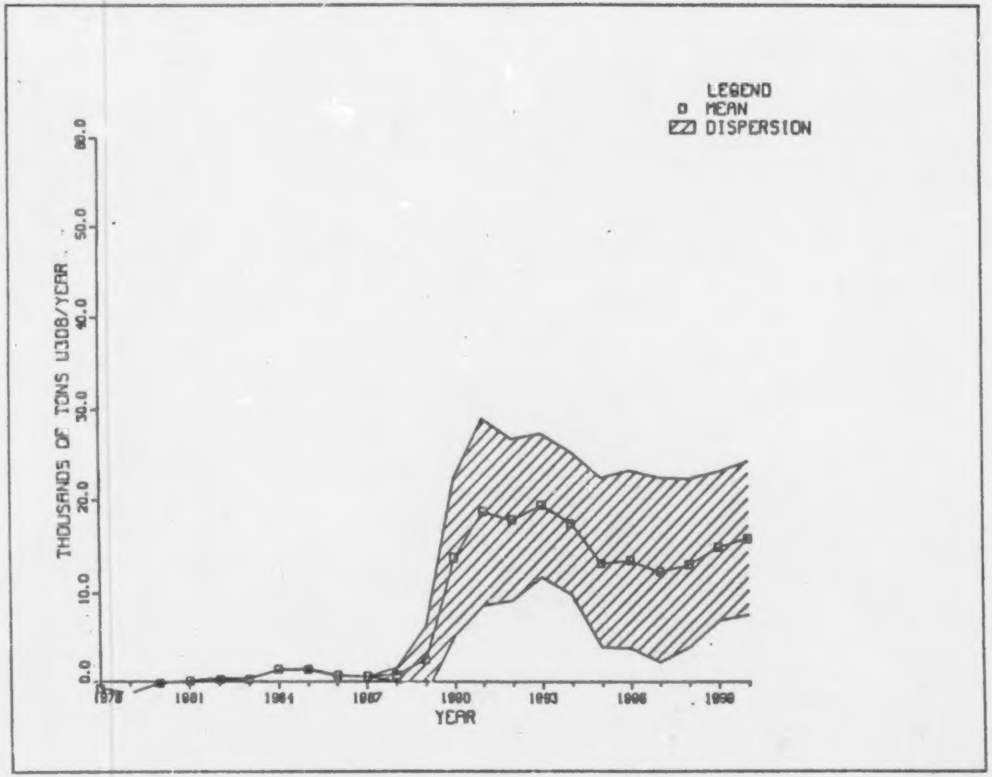

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FIGURE 6.4 IMPORT TARIFFS: COMPARISON OF MARKET PRICE DIFFERENCES FOR POLICY OPTIONS

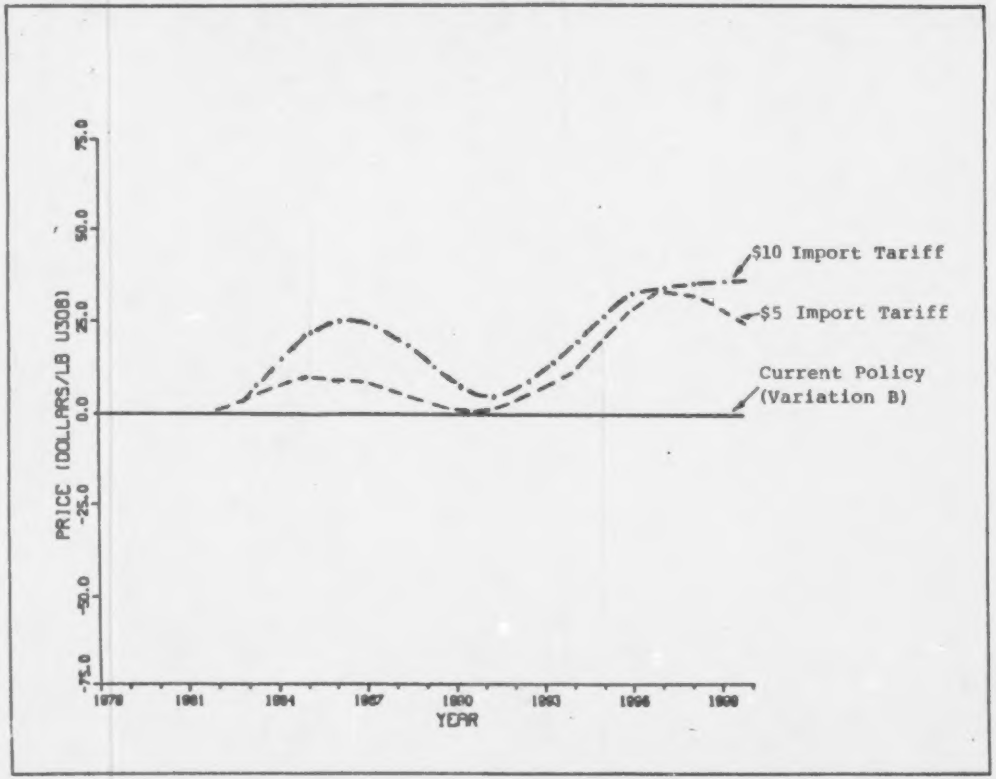

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FIGURE 6.5 IMPORT TARIFFS: COMPARISON OF DOMESTIC PRODUCTION DIFFERENCES FOR POLICY OPTIONS

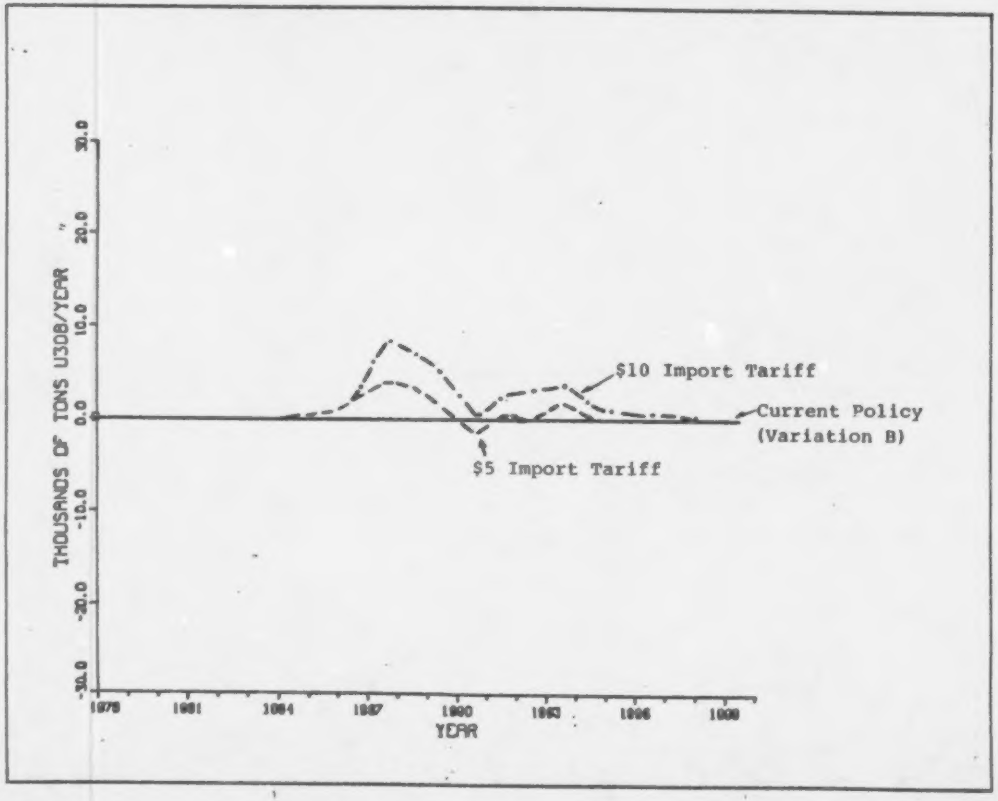

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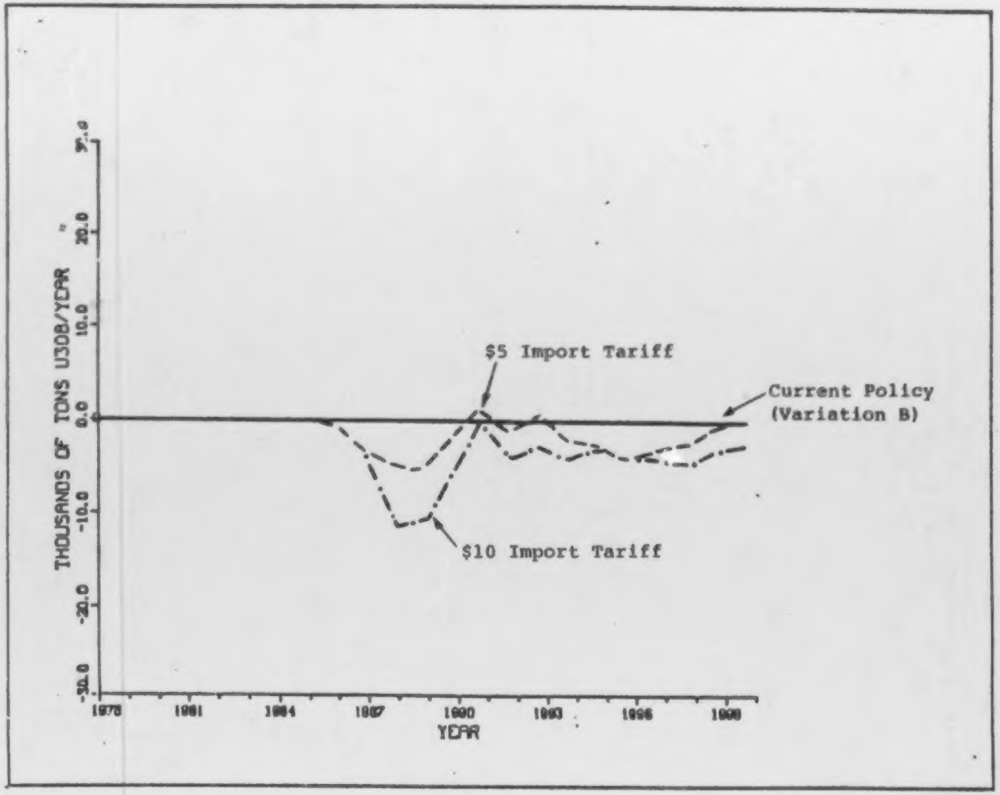
FIGURE 6.6 IMPORT TARIFFS: COMPARISON OF IMPORT DIFFERENCES FOR POLICY OPTIONS



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7. MODIFIED ENRICHMENT TRANSACTION POLICY

A consideration of terms of enrichment services expands the analysis along a new dimension. The "Modified Enrichment Transaction Policy" would allow the DOE, acting under the provisions of its contracts for enrichment services, to increase the so called "transaction tails assay" of its enrichment contracts, thereby increasing the enrichment customers' requirements for natural uranium feed material.

Currently, the enrichment contracts with DOE are of three types, and each type has rather complicated terms. Only two of the types (about half of domestic contracts) would be affected by a DOE policy to change the transaction tails assay. The other half of the contracts, the "adjustable, fixed-commitment" type, have terms that allow the customers to specify their own effective tails assay (within a pre-specified range), while keeping the amount of enrichment services at the contracted schedule. The impact of this flexibility is that customers with this last contract type are able to optimize, over a limited range, the economics of their nuclear fuel, balancing the cost of (and their requirements for) their uranium against the cost of enrichment services, provided their requirements for enrichment uranium can be varied.

The analysis presented here is simplified by ignoring the above mentioned flexibility because its proper incorporation would require a more sophisiticated analysis -- one input of which would be the projected price of uranium and enrichment services.

It is therefore assumed that the DOE would change its transaction tails assay from its current value of 0.2 percent U-235 to a new value of 0.25 percent. Under the terms of the enrichment contracts, this simplified analysis would require the enrichment customer to deliver about 9 percent more uranium feed material to produce the same quantity of enriched material from 1984 on. This action would inversely impact the customers' requirements for enrichment services. Since DOE bases its enrichment prices on a "full-cost recovery" basis, the spreading of less enrichment demand over the same fixed costs would necessitate an increase in enrichment prices.

The implementation of this policy results in changes in demand for uranium. The projection of market price, domestic production and imports under this policy are shown in Figures 7.1 through 7-3. It is readily observed that the impact of this policy option on the uranium market is estimated to be minimal. In the

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near term the reaction to this policy would be an increase of the rate of inventory drawdown by utilities rather than increase in domestic uranium production. Beginning in 1986, and continuing throughout the rest of the century the policy would induce an estimated $5 per pound higher market price of uranium than would occur under current policy. The increased demand would in the long run result in slight increases of both domestic production and imports about equally (less than 2,000 tons each annually).

Higher uranium prices and higher prices for enrichment services result is higher cost of finished nuclear fuel. Considering the current charge for enrichment services ($130.75 per separative work unit as of October 1, 1981) for the 0.20 percent transaction tails assay and using the projected prices of uranium the nuclear fuel cost component of nuclear generated electricity is calculated. Table 7.1 gives the projections of these costs (in mills per kilowatt-hour) throught the end of the century. The nuclear fuel cost is seen to increase by 0.4-0.7 mills per kilowatt-hour for this option.

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Table 7.1 Nuclear Fuel Cost

	0.20 percent tails			0.25 percent tails		
Year	Uranium Price ($/lb)	Enrichment Services ($/SWU)	Nuclear Fuel Cost (Mills/kWh)	Uranium Price ($/lb)	Enrichment Services ($/SWU)	Nuclear Fuel Cost (Mills/kWh)
1985	35	131	8.23	40	147	9.07
1990	30	131	7.73	30	147	8.91
1995	40	131	9.68	50	147	10.13
2000	55	131	10.18	55	147	10.66

SWU = Separative work unit

kWh = kilowatt-hour

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FIGURE 7.1 MODIFIED ENRICHMENT TRANSACTIONS: MARKET PRICE

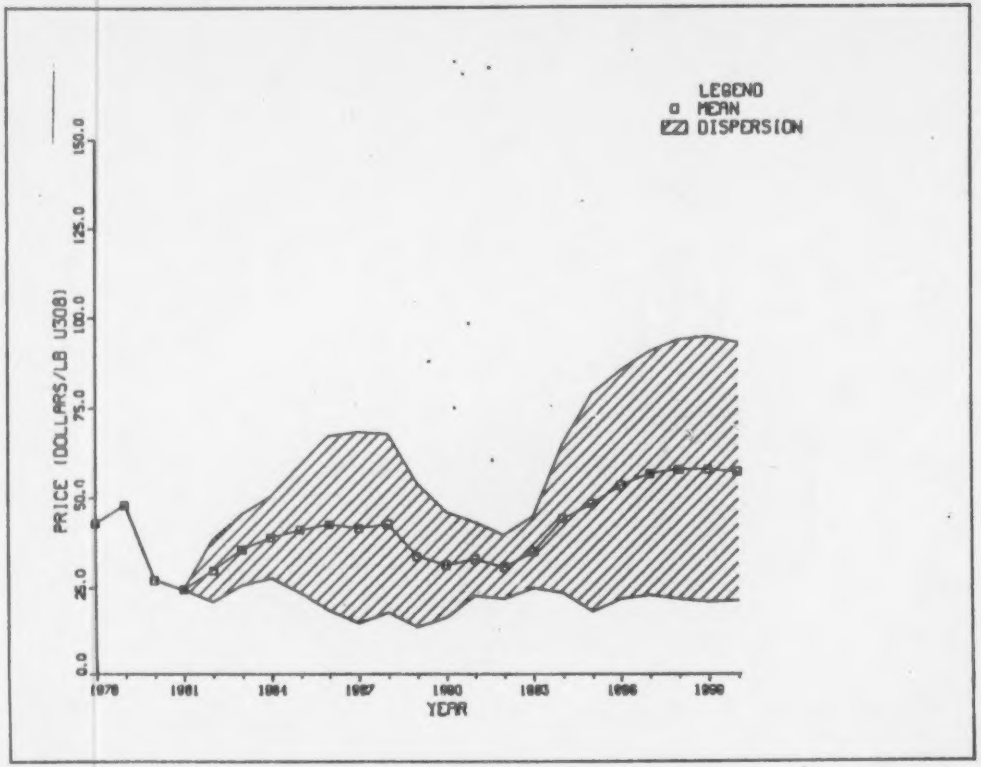

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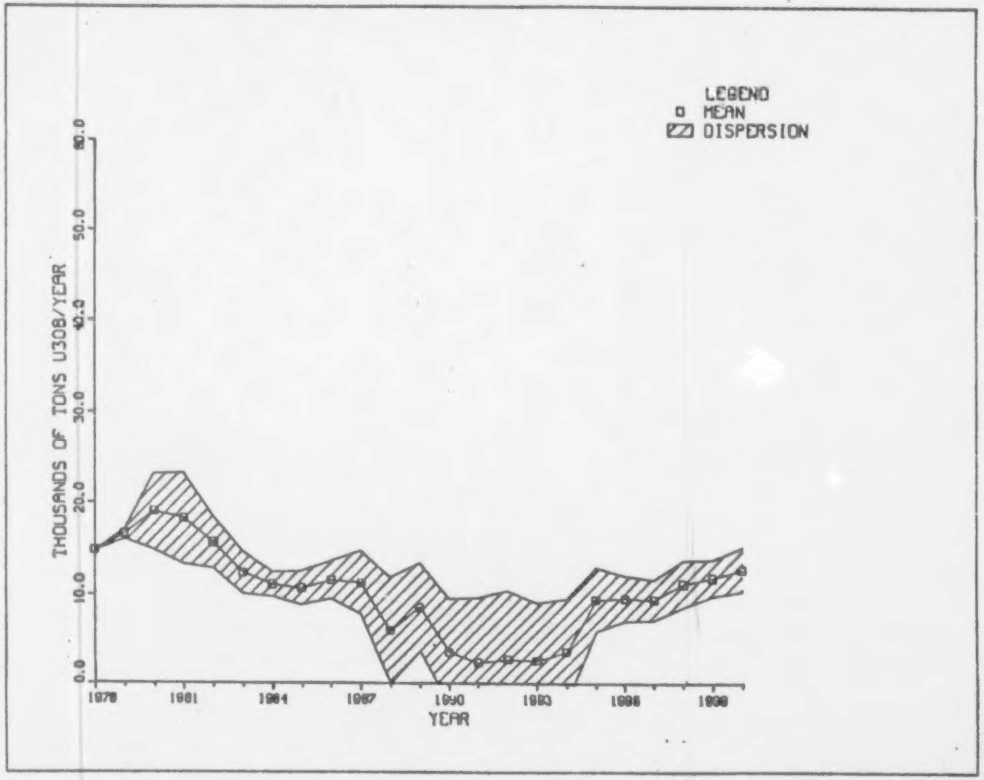
FIGURE 7.2 MODIFIED ENRICHMENT TRANSACTIONS: DOMESTIC PRODUCTION



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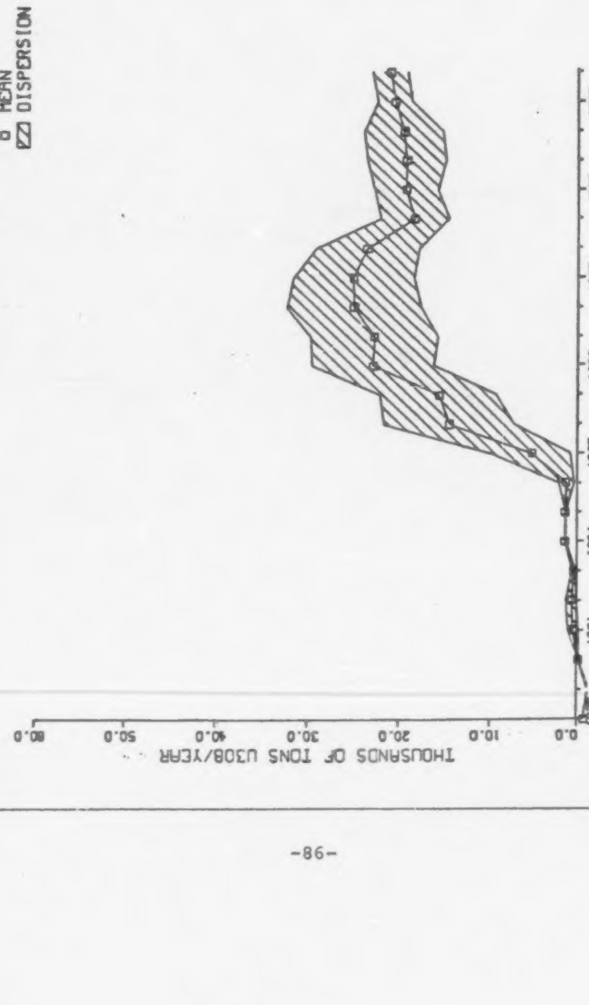

FIGURE 7.3 MODIFIED ENRICHMENT TRANSACTIONS: IMPORTS

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8. BUFFER STOCKPILING

Two buffer stockpiling policies designed to stabilize the uranium production and prices are considered. One is the "International Commodity Agreement" and the other is "Federal Stockpiling".

International Commodity Agreement

Under this policy, the parties to the international commodity agreement would determine the minimum and maximum world price which would activate purchases into or sales from a "buffer stockpile" to support the price or to hold down the price. To support the minimum price, purchases for the stockpile serve to increase demand accordingly. To limit price levels to the maximum price, sales from the stockpile serve to increase supply accordingly.

This analysis assumed a $40-$60 band and $50-$70 band of minimum/maximum uranium market prices. The projections of market price, domestic production, and imports are given in Figures 8.1 through 8.3. The comparison of the results achieved under this policy option with those under the current policy is shown in Figures 8.4 through 8-6.

The results show that under this policy option, the uranium price can be stabilized in a certain pre-determined range. Domestic production would be stimulated in late 1980's and early 1990's to an excess of 12,000 tons above the production under current policy. Similarly, the imports would be depressed approximately the same magnitude simultaneously.

However, to achieve the presented results, annual stockpile purchases as high as 20,000 tons of foreign uranium would have to be made, at a cost of as much as $2 billion per year. Furthermore, the liquidation of a stockpile of this size would present quite a formidable problem.

Federal Stockpiling

The second buffer stockpiling policy is a development of domestic stockpiles by the Government. Purchases for this stockpile would have a stabilizing effect on the market. An analysis of two variations has been performed: one for stockpiling of domestically produced uranium concentrate for 10 years at an

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annual rate of 2000 tons and the other for 5000 tons at an annual rate.

The results of the analysis show that this policy option has a limited range of applicability. It would be effective in buttressing the industry only over approximately the next 8 years -- the period when market demand would be low. Thereafter, the potential impact of imports could dwarf a reasonable Government stockpile program.

The comparison of market prices under this policy and those under the current policy is given in Figure 8.7 and shows that Government purchases of 5 thousand tons per year could have a transitory impact of about $10 per pound on the market price and cost the Government about $500 million per year.

It should be added, however, that a large strategic stockpile of uranium might be an effective deterrent to possible foreign supply disruptions, if the domestic utility industry were to come to rely heavily on foreign sources of supply.

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FIGURE 8.1 COMMODITY AGREEMENT: MARKET PRICE FOR $40-$60 PRICE SUPPORT RANGE

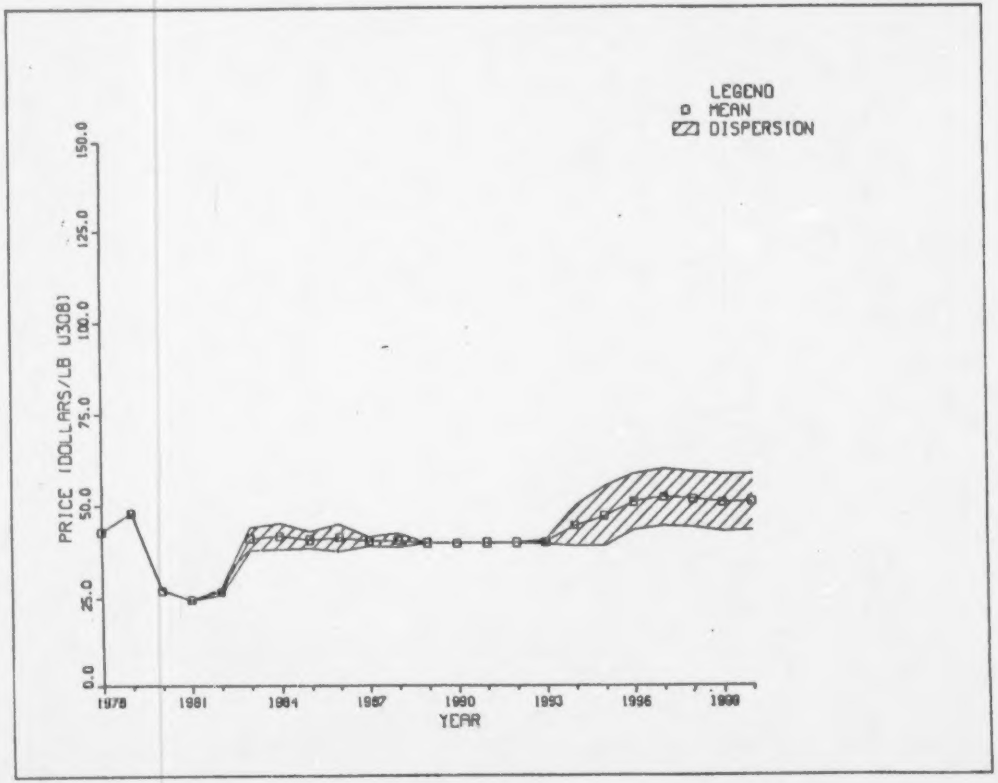

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FIGURE 8.2 COMMODITY AGREEMENT: DOMESTIC PRODUCTION FOR $40-$60 PRICE SUPPORT RANGE

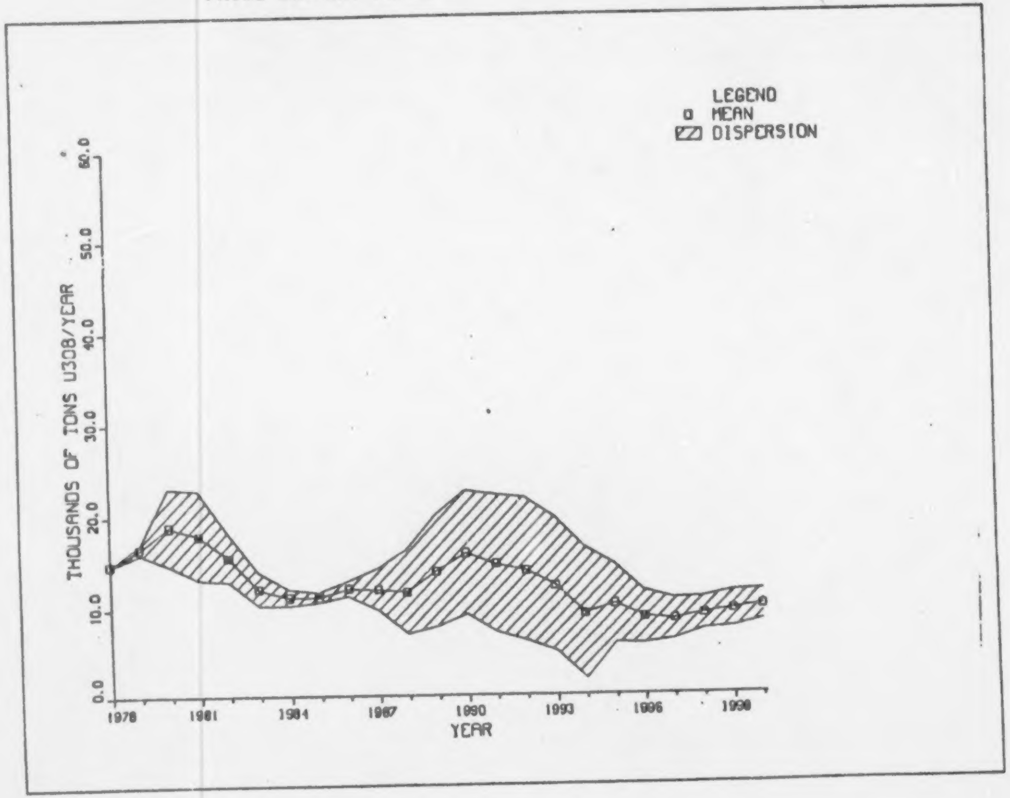

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FIGURE 8.3 COMMODITY AGREEMENT: IMPORTS FOR $40-$60 PRICE SUPPORT RANGE

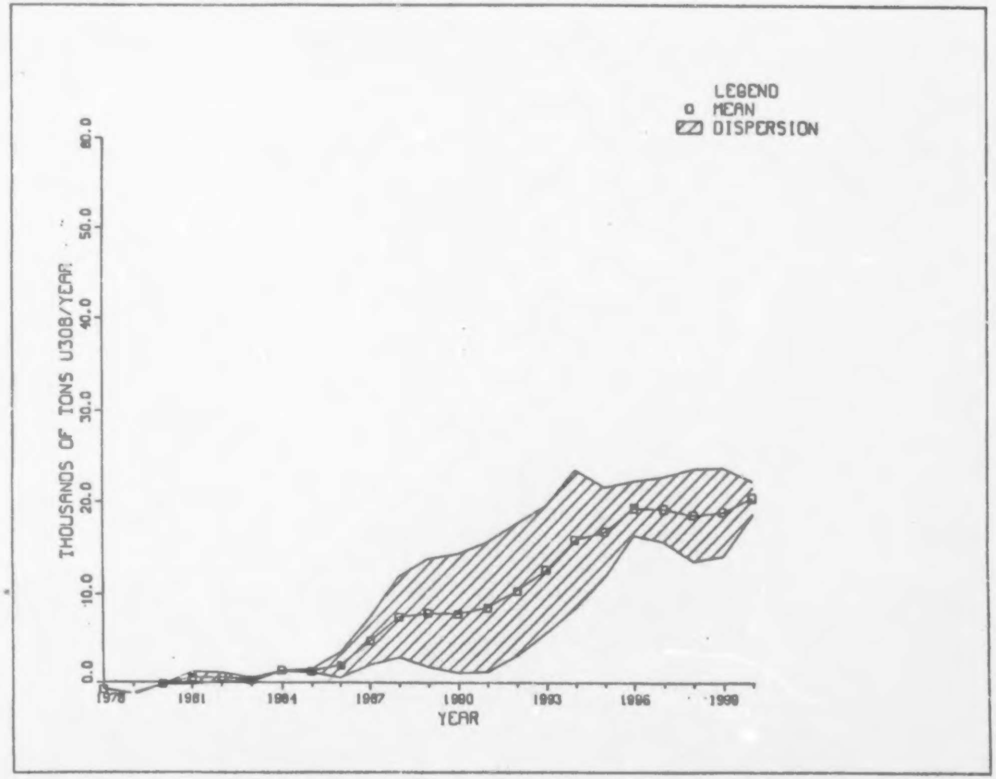

FIGURE 8.4 COMMODITY AGREEMENT: COMPARISON OF MARKET PRICE DIFFERENCES IN POLICY OPTIONS

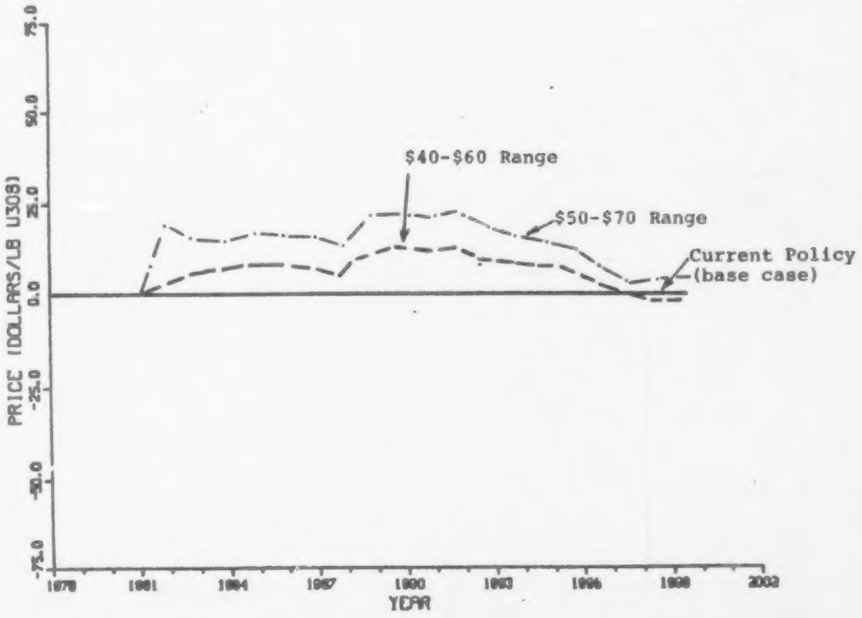

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Figure 8.5 Commodity Agreement: Comparison of Domestic Production Differences in Policy Options

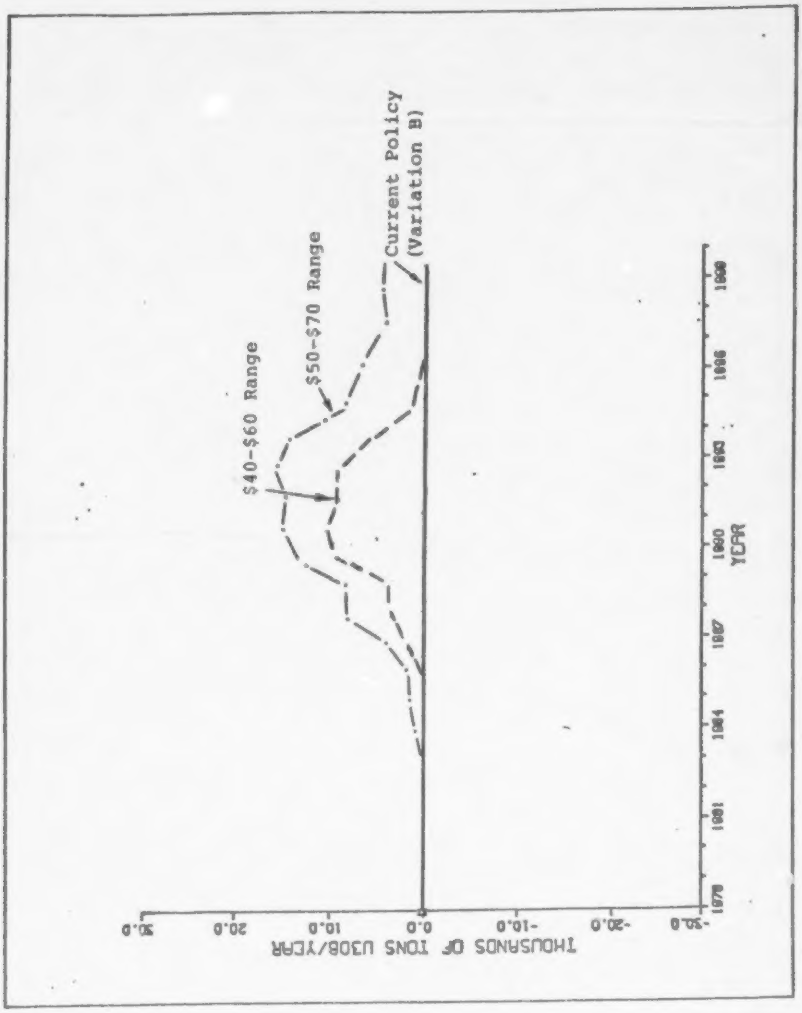


FIGURE 8.6 COMMODITY AGREEMENT: COMPARISON OF IMPORT DIFFERENCES IN POLICY OPTIONS

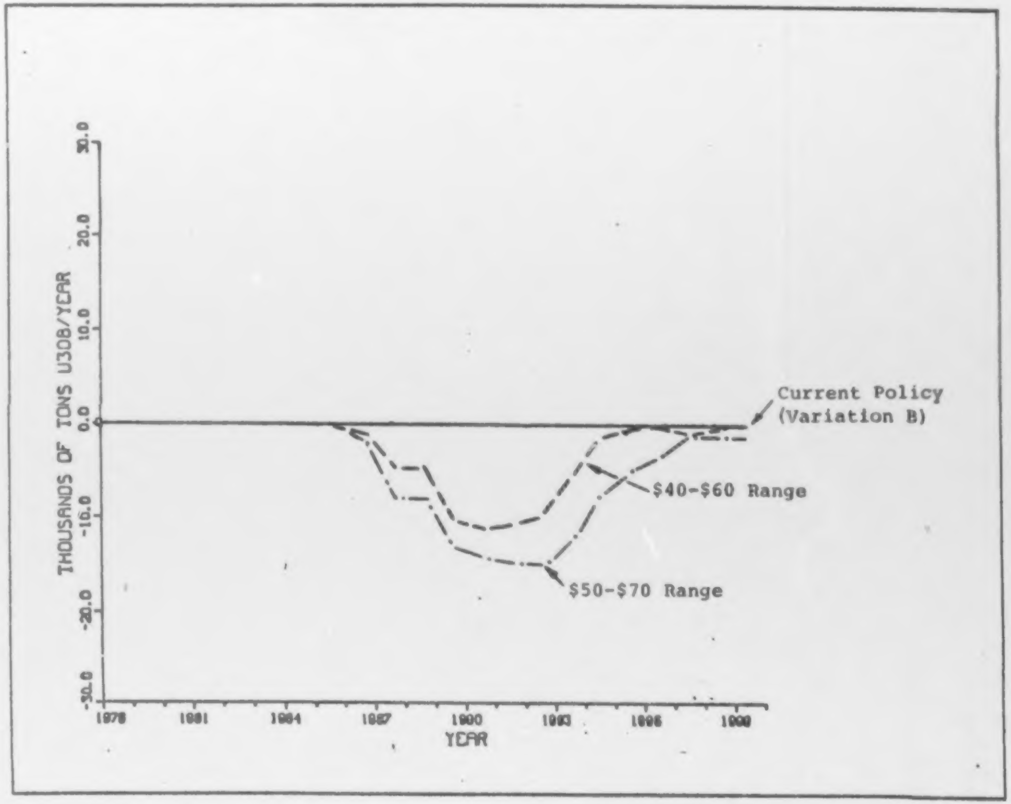
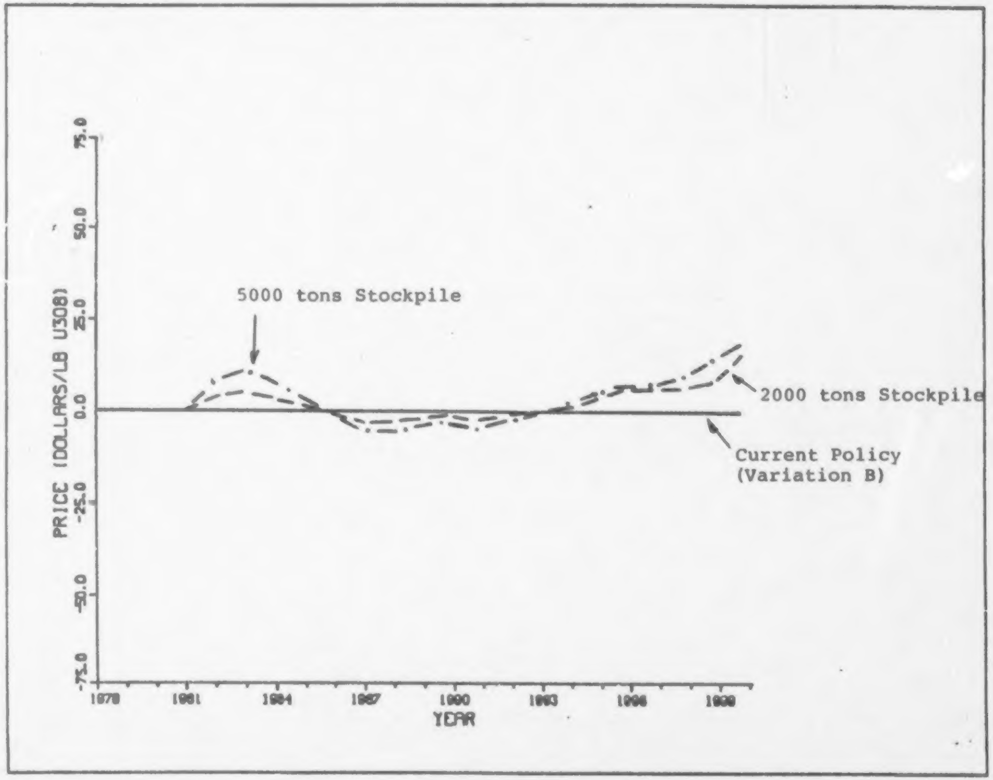


FIGURE 8.7 FEDERAL STOCKPILING: COMPARISON OF MARKET PRICE DIFFERENCES IN POLICY OPTIONS



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9. MONITORING "VIABILITY"

Although there appears to be no universally accepted measure of the uranium industry's viability, the Department of Energy is required by Section 161 v of the Atomic Energy Act, as amended, to take certain actions when the viability of the domestic uranium industry is threatened. Pursuant to this responsibility, the DOE and its predecessor agencies have regularly collected data, which are relevant to the question of uranium industry viability.

These data are collected directly from uranium producers and explorers, nuclear reactor manufacturers and electric utility companies with nuclear interest. Such surveys cover such things as production, employment, exploration, and other investment activity and a host of parameters on commercial contractual arrangements among domestic uranium buyers, sellers, and foreign parties. The data from these surveys are published in aggregate form, typically on an annual or semi-annual cycle.

For the most part, these survey efforts are quite adequate. For example, actual investment and exploration activity (and two-year forward plans) are extremely important indicators of industry growth and growth plans -- key activities and leading indicators of viability.

In addition, uranium production costs for domestic producers are collected, although on a more informal and less comprehensive scale than the other data collected. These data are very important to collect, although the question of its confidential nature is paramount.

Data on market prices, for contracts in which at least one party is domestic, are important indicators of viability, at least when compared with production costs. An important recent enhancement has been the addition of data on prices for future utility purchases of foreign uranium. An important point to note is that spot prices can move very quickly in the uranium market. A weakness in the current DOE data collection effort in this area is the inability to determine these rapid movements because of both the averaging of new contract prices with those old contracts on the survey responses. Fortunately there are alternate, publicly available sources for aggregate spot-market data. It should be recognized, as well, that the scope of these surveys has changed in concert with changes in the structure of the market place. This dynamic modification process has been vital to the proper monitoring of viabilty indicators.

In another area, this study indicates that the disposition of currently large inventories may dominate market activity for the next several years. Thus, it would perhaps be wise to expand the detail of surveys in this area.

Finally, the psychological impact of monitoring the industry's viability should not be discounted. The uncertainty created by the threat of an embargo reimposition, should it be found necessary through this monitoring process, may very well be an important deterrent to domestic utilities forging long-term commitments to foreign supplies and to massive infringement on the domestic market by foreign suppliers.

APPENDIX

Major Non-Policy Assumptions

Domestic Uranium Resource Base: Reserves plus all resource categories for the less-than-$100-per-pound forward cost category -- mean value, 4.90 million tons; 95th percentile, 3.88 million tons; 5th percentile, 6.06 million tons.
Source -- An Assessment Report on Uranium in the United States of America, Report GJO-111(80), October 1980.

Uranium Requirements: Estimated deliveries to the DOE enrichment complex by domestic enrichment customers.
Source -- Oak Ridge Operations Office, DOE.

Uranium Controls Currently in Place: Quantities and imbedded prices from DOE survey on January 1, 1981.
Source -- Survey of United States Marketing Activity, Report DOE/NE-0013, June 1981.

ANALYSIS AND RECOMMENDATIONS CONCERNING KEY INDICATORS OF U.S. URANIUM INDUSTRY VIABILITY

September 1981

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I. ROCKY MOUNTAIN ENERGY COMPANY

Rocky Mountain Energy Company (RME) is the Denver-based subsidiary of Union Pacific Corporation, responsible for developing the Corporation's coal, uranium, and trona reserves. During recent years, RME has had a growing role in developing United States uranium reserves through the operations of the Bear Creek Uranium Company in the southern Powder River Basin in Wyoming. In addition, RME has numerous exploration operations underway throughout the United States.

Rocky Mountain Energy believes the necessary growth of U.S. uranium production depends upon the development of reasonable federal policies. Through the reasoned efforts of the Executive Branch and the Congress, the United States can be assured that the viability of the domestic uranium industry will be maintained.

II. EXECUTIVE SUMMARY AND RECOMMENDATIONS

The domestic uranium industry is currently in an extremely critical condition. In addition to other major issues affecting uranium industry viability, the current condition of the industry is the result of:

- the dramatic reduction in the development of U.S. nuclear power capacity;
- the substantial decline in the price of uranium; and,
- the current and projected use of foreign uranium to meet U.S. reactor needs.

These factors have caused the U.S. uranium-producing industry to either slow down, suspend, or terminate domestic uranium operations. The ability of the uranium industry to meet U.S. reactor requirements may be jeopardized unless the federal government takes immediate action to ensure that a viable domestic uranium industry is maintained in the United States.

The maintenance of a viable domestic uranium industry is essential to meet domestic energy needs. The Joint Committee on Atomic Energy recognized this fact in 1964 and amended the Atomic Energy Act of 1954 to require the maintenance of a viable domestic uranium industry. Section 161(v) of the Atomic Energy Act of 1954, as amended, provides:

> "...to the extent necessary to assure the maintenance of a viable domestic uranium industry," the Department of Energy "shall not offer (enrichment) services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States." (42 U.S.C.A., Sec. 2201(v), (1973), emphasis added.)

Pursuant to this provision, therefore, an affirmative obligation exists for the federal government to maintain a viable domestic uranium industry. To the extent that a non-viable uranium industry exists in the United States, the federal government must establish policies to help

● Inventories	Utility-held inventory levels approximate 55 thousand tons and represent 3.8 years forward coverage -- this is in contrast to the preferred inventory level of 1½ years. Many utilities have sold excess inventories which has assisted in driving down the spot market uranium price. (See pages IV-26 through IV-28.)
● Reserves	Due to the significant drop in uranium prices, economically-recoverable U.S. uranium reserves have dropped significantly. In 1981, DOE estimated that 112 thousand tons U_3O_8 will exist in the \$30 forward cost category; this compares to the 1979 DOE estimate of 290 thousand tons U_3O_8 in the same category. (See pages IV-9 through IV-11.)
● Costs	According to DOE, in view of decreasing productivity, lower ore grades, and increased regulations, uranium production costs have more than doubled from 1973 to 1980.
● Production Capability	Under current conditions, projected U.S. production capabilities will drop by more than 60 percent over the next 10 years. (See pages IV-16 through IV-26.)

Uranium Prices

Spot market prices have declined from a 1979 peak of $43.25 per pound to the July 1981 level of $23.50 per revitalize the industry. Timely action by the government will ensure the production of energy resources to meet U.S. energy needs. Without appropriate actions taken by the federal government, the U.S. uranium industry will continue to deteriorate and eventually fail to produce necessary U.S. reactor fuel requirements.

Key indicators reflecting the present non-viable condition of the U.S. uranium industry include:

Uranium Demand

- U.S. Nuclear Power Development
- Uranium Contracting

Uranium Supply

- Exploration
- Inventories
- Reserves
- Production Capability
- Costs

Uranium Prices

Employment

Productivity

Capital Investments

Foreign Uranium Production

- Production Costs
- Production Capability
- Marketing Efforts in U.S.

U.S. Federal Nuclear/Uranium Policies

- Atomic Energy Act of 1954 Section 161(v)

- Uranium Mill Tailings Radiation Control Act of 1978

- U.S. Nuclear Power Policies and Regulations

Section IV of this analysis provides a thorough assessment of key indicators of U.S. industry viability; it clearly indicates that the industry is in a non-viable condition and that appropriate action should be taken by the federal government to help revitalize the uranium industry. The following descrption of each of these key indicators presents a brief summary of the current non-viable condition of the industry.

Uranium Demand

● U.S. Nuclear Power Development	All projections of U.S. nuclear power have been sharply reduced since 1974 -- further development is highly questionable. (See pages IV-1 through IV-9.)
● Uranium Contracting	Long-term commitments between domestic uranium producers and buyers decreased since the beginning of 1980. Spot market activity has been constant as a result of utilities selling excess inventories. (See pages IV-28 through IV-34.)

Uranium Supply

● Exploration	Surface drilling and exploration expenditures have declined significantly over the past 18 months. According to the Department of Energy, if these trends continue over the next few years, U.S. exploration activity may not be adequate to assure that the U.S. will be able to meet long-term needs largely from domestic sources. (See pages IV-11 through IV-16.)

	pound; in constant dollars the price has dropped almost 60 percent in only 2 years. (See page IV-28.)
Employment	Over 8,000 of the estimated 22,000 uranium industry workers have been laid off since January 1980. Many uranium companies expect moderate to extreme difficulty in attracting skilled workers when production begins again or is increased to normal capacity. (See pages IV-34 through IV-36.)
Productivity	According to the DOE, a continuing loss of productivity in the uranium industry may be expected.
Capital Investments	While planned expenditures for mine and mill facilities show limited increases, these are subject to major revisions as the market continues to deteriorate. (See pages IV-11 through IV-16.)
Foreign Uranium Production	
• Production Capability	Plans for new, low-cost foreign production centers remain firm. Uncommitted foreign production capability for Canada and Australia together could supply a total of 15.4 thousand tons of uranium to the United States by 1990 -- this amount exceeds projected U.S. unfilled requirements of only 11.6 thousand tons in that year. (See pages IV-58 through IV-69.)

● Production Costs	Projected levels of uranium production at less than $20 per pound in 1990 will decrease by 94 percent in the United States while the foreign level will actually increase by 35 percent. (See page IV-61.)
● Marketing Efforts in the United States	Since 1980, one new long-term supply contract between a U.S. utility and a foreign producer was signed and at least two more such contracts are awaiting final approval. Several additional U.S. utilities are said to be in negotiation with foreign producers. (See pages IV-28 through IV-34.)

U.S. Federal Nuclear/Uranium Policies

● Atomic Energy Act of 1954 Section 161(v)	The existing policy permitting the increased use of foreign uranium to supply U.S. energy needs serves as a disincentive for domestic utilities to procure domestic uranium supplies. (See pages III-1 through III-4.)
● Uranium Mill Tailings Radiation Control Act of 1978	Nuclear Regulatory Commission and Environmental Protection Agency regulations and standards promulgated pursuant to this Act have established unnecessarily stringent operating criteria and have increased uranium production costs. (See pages IV-72 through IV-74.)

• U.S. Nuclear Power Policies and Regulations	The delay in licensing nuclear reactors and finally establishing federal policies pertaining to nuclear waste storage and reprocessing of nuclear fuel have significantly affected the development of nuclear power in the United States. (See pages IV-1 through IV-9.)

To maintain a viable domestic uranium industry, Rocky Mountain Energy recommends that:

- The Nuclear Regulatory Commission (NRC) should expedite licensing processes for nuclear reactors in order to minimize future delays. Delays resulting from NRC licensing procedures have been, in part, responsible for the declining uranium demand; this seriously threatens the viability of the domestic uranium industry. (See page IV-1.)
- The Department of Energy (DOE) immediately amend existing enrichment criteria with the purpose of maintaining a viable domestic uranium industry. DOE should establish a 20 percent enrichment limitation on the amount of foreign uranium a domestic utility could enrich on an annual basis for domestic end-use. This limitation should begin immediately and remain in effect until the year 2000, or until such time as the government determines that the domestic uranium industry is viable and that increased imports of uranium will not affect the viability of the industry. (See pages IV-69 and IV-70.)
- The Department of Energy should define "viable domestic uranium industry." This report demonstrates that the uranium industry in the U.S. is no longer "viable." (See also, Atomic Energy Act,

as amended, Sec. 161(v).) In order to revitalize the domestic uranium industry, it is strongly suggested that the Department of Energy define "viable domestic uranium industry" as one having the confidence and capability "to grow and develop, sustain its position, and anticipate growth and profit over the long term to justify the risk of investment." Establishing this working definition will assist the Department of Energy and other federal departments, in establishing federal policies to maintain a viable domestic uranium industry. In addition, it will assist the federal government and the industry in compiling pertinent information regarding "maintenance of a viable domestic uranium industry." (See Sections IV-A and IV-D.)

- The Nuclear Regulatory Commission and the Environmental Protection Agency reopen respective rulemaking proceedings to reconsider regulations significantly affecting the current state of the uranium industry. NRC mill tailings regulations and the Environmental Protection Agency's radiation dose standards have had, and will have, the significant effect of adding substantial costs to uranium production without the commensurate benefit of increased safety to the public. (See page IV-72.)

- The Nuclear Regulatory Commission, the Environmental Protection Agency (EPA), the Department of Energy, the Department of State (DOS), and the Office of the U.S. Special Trade Representative (STR), should jointly and frequently review respective federal policies and regulations which affect the viability of the domestic uranium industry (e.g., NRC mill licensing regulations; EPA radiation dose standards; DOE foreign uranium enrichment policy; DOS export/import licenses; and, STR international trade policies). This review should be undertaken with the purpose of establishing uniform and consistent federal actions which affect the viability of the domestic uranium industry.

- The Department of Energy should undertake periodic reviews of the viability of the domestic uranium industry. It is suggested that at least every three years the Department of Energy thoroughly assess relevant issues affecting uranium industry viability.

Rocky Mountain Energy Company looks forward to working with the Congress and the Executive Branch to ensure the maintenance of a viable domestic uranium industry. We will be glad to answer any questions concerning our analyses and recommendations, or comments made within this report.

* * *

III. U.S. URANIUM INDUSTRY VIABILITY

A. U.S. Need for Nuclear Power

The United States currently has 52,747 electrical megawatts of installed nuclear power in commercial operation. In recent years, up to 13 percent of all the electricity used in the U.S. was generated from nuclear power. The United States presently has on order, or in various stages of construction, an additional 92,500 megawatts of nuclear generation. If this additional nuclear generating capacity is completed, it could save an equivalent of 4.5 million barrels of oil per day. It is essential to the national economic well-being and national security interests that existing nuclear generating plants remain in operation, and that new plants be licensed to operate at the earliest possible date.

The National Academy of Sciences concluded in its report, Energy in Transition: 1985-2010, that:

> "Coal and nuclear power are the only economic alternatives for large-scale application in the remainder of this century."

The study was conducted by distinguished professors from Stanford University, Massachusetts Institute of Technology (MIT), Harvard Medical School, and the University of California. It was submitted to the Department of Energy (DOE) in January 1980, and displays the need for the federal government to: expedite nuclear licensing proceedings; establish nuclear waste facilities; reestablish reprocessing of spent nuclear fuel; and, maintain a viable domestic uranium industry to meet future U.S. energy needs.

It should be noted that the American public supports nuclear power. Polls consistently have shown that more Americans recognize the need for nuclear power and support it than those who oppose it.

B. Atomic Energy Act Section 161(v) - Maintaining a Viable Domestic Uranium Industry

The United States must use each domestic energy resource to remain free from uncontrollable foreign government actions. The 1973 oil embargo, continuous OPEC price increases, and instability in the Middle East, clearly point to the absolute need for the United States to establish positive federal policies directed toward the efficient use and responsible development of all domestic energy resources.

The maintenance of a viable U.S. energy industry is essential to meet domestic energy needs. The Joint Committee on Atomic Energy in 1964 recognized this fact and amended the Atomic Energy Act of 1954 to require the maintenance of a viable domestic uranium industry. Section 161(v) of the Atomic Energy Act of 1954, as amended, provides:

> "...to the extent necessary to assure the maintenance of a viable domestic uranium industry", the Department of Energy "shall not offer (enrichment) services for source or special nuclear materials of foreign origin intended for use in a utilization facility within or under the jurisdiction of the United States." (42 U.S.C.A., Sec. 2201(v), (1973), emphasis added.)

Recent congressional consideration of domestic uranium industry viability highlighted the importance uranium plays in meeting the nation's energy needs. Senator Peter Domenici (R-New Mexico), indicated that his 1980 amendment requiring the Department of Energy to conduct a formal rulemaking to determine the viability of the uranium industry

> "...will begin the process of reevaluating the viability of this very important energy ingredient and piece of America's future energy policy. We need to review the ablity of our domestic mining and processing industry to meet future domestic needs of uranium...," (Cong. Rec., September 8, 1980, S. 12255).

Senator Domenici added that it was his intention for the Department of Energy to determine the viability of the uranium industry in the context of establishing a new policy regarding the importation of foreign uranium which is "related to a present day analysis of the viability of the uranium and uranium-mining industry in this country." The Domenici amendment was deleted without prejudice during conference action, but the Department of Energy agreed to undertake an informal assessment of the domestic uranium industry.

These recent actions demonstrate Congress' concern about the maintenance of a viable domestic uranium industry. The importance of the issue was highlighted during the Secretary of Energy confirmation hearings when Mr. James B. Edwards' stated:

> "...it's absolutely essential from a national security point of view that we have a viable uranium industry in America...". (Hearings before the Committee on Energy and Natural Resources, U.S. Senate, 97-2, p. 31, January 12, 1981.)

The Department of Energy released its draft report "The Domestic Uranium Mining Industry and Imports of Uranium" on December 11, 1980. The draft report addresses the issues DOE considers important in connection with the viability of the domestic uranium industry. Major areas covered in the report include employment, productivity, revenues, inventories, production, contracts for future imports and exports, average prices, foreign production capability, and historical import levels.

Department of Energy officials met with industry representatives during December 1980 to receive comments on the draft report. In addition, DOE officials requested written industry comments to assist in their assessment of the viability of the domestic uranium industry. RME prepared and submitted a response entitled "Rocky Mountain Energy Company Comments on the Department of Justice Draft Report of The Domestic Uranium Mining Industry and Imports of Uranium" on February 9, 1981.

In addition to the initial DOE draft report concerning uranium industry viability, Senator Domenici requested that the Energy Information Administration assess uranium policy options concerning the importation of foreign uranium. In addition, Senator Domenici requested EIA to determine the key indicators of U.S. uranium industry viability which should be monitored in the future. It is expected that the EIA report will indicate the critical condition of the industry and the immediate need for appropriate government action to help revitalize the U.S. uranium industry. Rocky Mountain Energy will continue to work with the EIA to help in their efforts to accurately characterize the uranium industry and the effect of foreign uranium on domestic uranium producers.

It is expected that the initial DOE report, "The Domestic Uranium Industry and Imports of Uranium," and the EIA analysis will serve as a basis upon which Congress and the Administration will act to maintain a viable domestic uranium industry. It is clear that the government, pursuant to Section 161(v) of the Atomic Energy Act, is obligated to maintain a viable uranium industry.

The following RME analysis is also offered in the context of our wholehearted support and approval of the federal government's efforts to thoroughly assess the viability of the domestic uranium industry and the impact of foreign uranium on the domestic uranium industry. It is our sincere desire that the work being done by the federal agencies to review the viability of the domestic uranium industry, will have the urgently needed effect of raising Congress' awareness of the serious plight of the domestic uranium industry. Rocky Mountain Energy strongly supports the efforts of the Department of Energy, the Department of State, the Office of the U.S. Special Trade Representative, and the Congress, to understand and assess the viability of the domestic uranium industry. It is clear to us, and we hope it is clear to the federal government, that maintenance of a viable domestic uranium industry is in the long-term national interest.

The Rocky Mountain Energy analysis has been undertaken to assist the federal government in its review and consideration of new policies affecting the domestic uranium industry. The following analysis addresses major issues directly relating to uranium industry viability. In addition, the RME analysis addresses the following questions:

- What is the current state of health of the industry and the future outlook?
- What are the principal problems facing the uranium industry?
- To what degree is foreign uranium a problem for the industry?
- What actions can the government take to alleviate industry problems?

C. Department of Energy Report - "The Domestic Uranium Industry and Imports of Uranium," - Highlights

Pursuant to an official congressional request from Senator Peter Domenici, the Department of Energy conducted a study of the domestic uranium industry and imports of uranium. The study was completed in July 1981 and essentially indicates that:

- A plausible cause of events under current U.S. policies is the increasing use of foreign uranium and the development of price differentials between domestic and foreign uranium sales.
- Numerous reductions in uranium-related employment are taking place.
- A significant drop in uranium spot prices has occurred.
- Domestic uranium production costs are high compared to foreign production centers.
- Domestic uranium supplies exceed demand for at least the next five years.
- Low cost foreign deposits have been discovered recently and foreign uranium producers could well seek out the U.S. uranium market.
- A sharp reduction in domestic uranium demand has occurred.
- Domestic uranium exploration efforts have decreased and may not be adequate in future years to meet U.S. requirements from domestic resources.
- Increases in foreign exploration by U.S. companies, coupled with decreases in U.S. exploration, indicate an increasing preference for exploration outside of the United States.
- A widespread curtailment in U.S. uranium production began in 1980.

- Excess foreign uranium production exists and at costs less than $30 per pound could fill a substantial portion of unfilled U.S. demand.
- A continuing loss of productivity has occurred which is an important factor with respect to the U.S. uranium industry's costs and ability to compete with foreign uranium.
- A sharp reduction in development of U.S. nuclear power has occurred and further downward revisions can be expected.
- A continuing buildup of uranium inventories will take place which will continue to be of concern to domestic uranium producers as another source of competition.
- Utility procurement policies essentially preferring domestic resources should continue depending if there remains only minor price differentials between foreign and domestic uranium.
- State public utility commissions may be effective in forcing domestic utilities into procuring foreign, low-cost uranium by refusing to approve rate increases.
- A two-fold increase in deliveries of foreign uranium intended for domestic end-use to U.S. enrichment plants occurred between 1977 and 1979.
- A significant weakening of long-term contract prices for uranium has taken place.
- New production centers in Australia and Canada are significantly increasing foreign production capability.
- Significant amounts of low-cost foreign uranium remain to be sold and additional foreign uranium production centers will increase the amount available.

- Further monitoring of the critical condition of the uranium industry and foreign production and sales should be undertaken.

The Department of Energy uranium report clearly indicates that the domestic uranium industry is currently nonviable. It should be noted that the factual representations within the DOE report are based primarily on 1980 data accumulated from the industry and government sources. Since January 1981 the industry and uranium market have deteriorated. This further emphasizes the need for appropriate and immediate federal action to help revitalize the domestic-producing industry.

* * *

IV. ASSESSMENT OF DOMESTIC URANIUM INDUSTRY VIABILITY AND THE IMPORTS OF URANIUM

A. The Domestic Uranium Industry

- Summary

The current status and outlook of the domestic uranium industry does not indicate a viable domestic industry (i.e., the capability to grow and develop into the future). Some indicators of this non-viable condition include: reduced domestic exploration activity and increased interest by domestic producers in foreign uranium resources; uncertain future domestic uranium production; significantly diminished uranium demand; uncertainty relating to projected new nuclear power capacity; and, the potential for significant impact of foreign uranium on the domestic uranium industry.

1. URANIUM DEMAND

a. Historical Forecasts of Nuclear Power

Projections for nuclear power in the U.S. have been steadily decreasing in recent years. Table IV-1 and Figure IV-1 illustrate reductions made in Department of Energy (DOE) nuclear power forecasts. In 1974, DOE forecast 102 gigawatts (GWe) nuclear capacity would exist by 1980; there are only 52 GWe in 1981. The 1974 forecast included a 1,090 GWe projection for the year 2000. The revised 1981 forecast estimates only 150 GWe in 2000; almost a 90 percent reduction in the long-term outlook. Since 1974, uncertainty caused by the sustained lowering of the long term nuclear outlook has had a significant effect on the uranium market. Major setbacks in U.S. nuclear power development have significantly reduced the positive outlook for a healthy uranium industry.

Three factors have significantly affected the decline of planned and existing nuclear capacity. First, financing of new nuclear generating stations must be undertaken in the context of high interest rates, increased construction costs resulting from power plant licensing delays, and the unwillingness of public utility commissions to allow needed rate increases.

TABLE IV-1

HISTORICAL FORECASTS OF U.S. INSTALLED NUCLEAR CAPACITY (MID CASE)

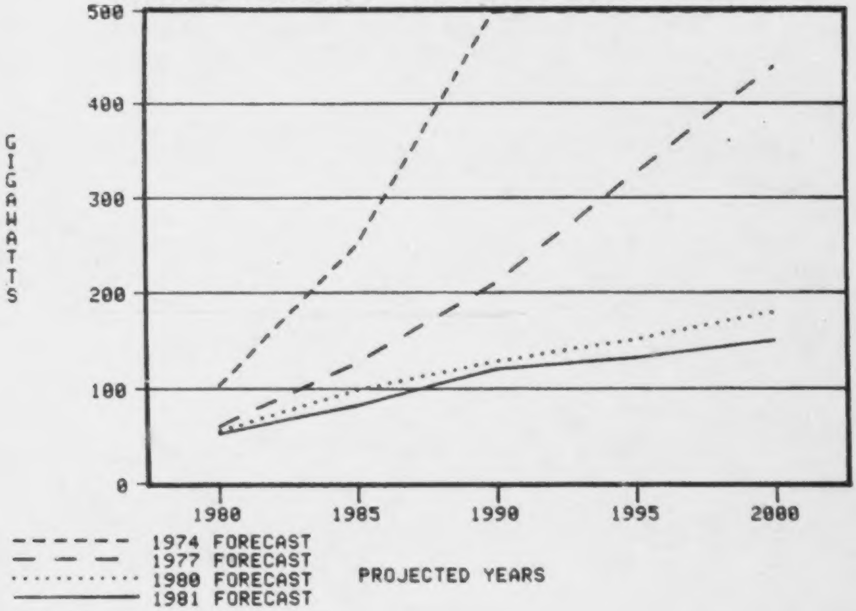
(gigawatts)

Year of Forecast	1980	1985	1990	1995	2000
1974	102	250	475		1090
1975	76	185	340		800
1976	67	145	250		510
1977	60	127	210		440
1978	65	111	172		325
1979	63	114	157	408	260
1980	55	98	128	151	180
1981	52	81	120	132	150

SOURCE: Colorado Nuclear Corporation, 1980.

FIGURE IV-1

HISTORICAL FORECASTS OF INSTALLED US NUCLEAR CAPACITY



Second, the electricity demand growth rate has declined in recent years. The currently low growth rates, shown in Figure IV-2, have impacted the long-term outlook for development of all forms of U.S. electrical generation capacity. However, the low point in 1980 may well be the completion of a cycle beginning in 1974, immediately following the oil embargo when conservation was at an all-time high. Even a slow recovery of the electricity growth rate in the next few years could have a significant impact on utilities' ability to provide the necessary power.

Third, nuclear opponents have successfully impeded responsible nuclear development throughout the country. Tactics utilized by these groups include: (1) establishing moratoria on nuclear development (e.g., precluding construction of a planned facility, or stopping operation of an existing facility) through anti-nuclear/uranium initiatives; and, (2) encouraging passage of unreasonable state and federal legislation limiting nuclear development. These factors have resulted in numerous cancellations and delays in nuclear power plants.

b. Current Forecasts of Nuclear Power and the Demand for Uranium

The current (June 1981) DOE forecast is for installed capacity to increase to 93 GWe by 1985 and to 127 GWe by 1990. (See Table IV-2.) Reactor requirements for uranium are forecast to be 14.4 thousand tons U_3O_8 in 1981, 21.9 to 25.8 thousand tons by 1985, and 24.6 to 27.8 thousand tons by 1990. (Table IV-3.)

In addition to the negative factors affecting projected installed reactor capacity, changes in U.S. government enrichment policies have also contributed to continued lowering of uranium forecasts for reactor requirements. The Long-Term Fixed Commitment (LTFC) enrichment contract was initially implemented by DOE in 1973 and provided for a firm schedule of enrichment services on a rolling 10-year basis. Utilities committed themselves to schedules of future uranium deliveries based on their forecasts of reactor growth. Inflexibilities of the contracts were such

FIGURE IV-2

HISTORICAL US ELECTRICITY GROWTH RATES

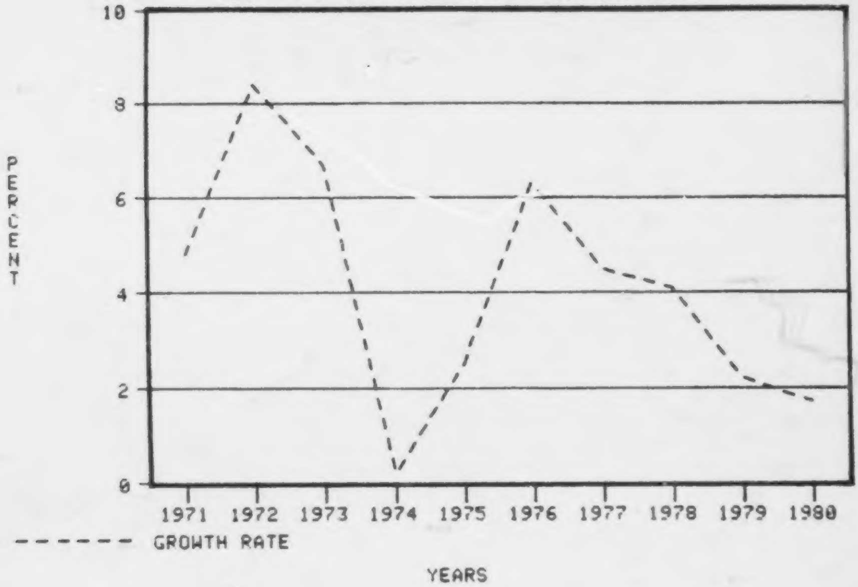


TABLE IV-2

CURRENT FORECAST OF
U.S. INSTALLED NUCLEAR CAPACITY
(gigawatts)

Year	Low	Mid	High
1985	81	93	99
1990	120	127	133
1995	132	142	155
2000	150	170	195

SOURCE: DOE, June 1981.

TABLE IV-3

CURRENT FORECAST OF U.S. URANIUM REQUIREMENTS

(tons U_3O_8 x 1000)

Year	Low	Mid	High
1981	14.4	14.4	14.4
1982	16.9	17.1	18.4
1983	18.8	18.9	21.8
1984	19.7	19.9	22.3
1985	21.9	21.9	25.8
1986	22.6	24.5	25.3
1987	23.3	24.2	25.0
1988	24.0	24.9	26.4
1989	23.8	24.9	27.2
1990	24.6	26.2	27.8

SOURCE: DOE, June 1981.

that utilities were unable to reduce uranium deliveries to accommodate changes in reactor start-up dates due to lower electricity demand forecasts and delays in reactor licensing. As a result, purchases of uranium to meet enrichment contracts continued to increase, even while real demand (as needed by reactors) for uranium was decreasing.

In 1978, DOE offered a new enrichment contract referred to as the Adjustable-Fixed Commitment (AFC) contract. The new contract provided greater flexibility and enabled utilities to reduce uranium delivery schedules significantly to better coincide with actual reactor requirements. Since utilities built inventories due to the mismatch in their uranium purchases and their actual reactor needs, they now bought only the uranium for which they were contractually committed. Consequently, the artificially high demand created by the earlier LTFC contracts was not only adjusted to correspond to revised reactor schedules, but also effectively reduced to the other extreme. RME supports DOE's change to AFC contracting. It should be pointed out, however, that the late timing of the change and the false demand and buildup of inventories prior to this change has had a deleterious effect on the recent domestic uranium market.

With a history of continually-decreasing forecasts of nuclear power and reactor requirements for uranium, the future of the uranium-producing industry remains highly uncertain as additional cutbacks appear to be imminent. An allowance for a continuation of this decline must be made in assessing the status of the current uranium-producing industry and its viability in the future. It is difficult for producers to maintain existing and planned production levels in light of uncertain uranium demand. Also, the relatively low level of demand existing in the current market could force numerous existing uranium producers out of operation.

The possibility of resuming reprocessing of spent fuel poses an additional degree of uncertainty about the level of future uranium requirements. Reprocessing effectively lowers uranium demand by approximately 20 percent by removing that amount of unused fissionable material (excluding plutonium) from the spent fuel and enabling it to be "recycled" and added back into the fuel supply stream. If the current federal policy changes to allow reprocessing and the shelved plans for private reprocessing plants are reinstituted, reprocessing could impact the U.S. market by the late 1980's. RME supports the reinstitution of reprocessing but emphasizes that the federal government should clearly establish a reprocessing policy in the very near future. A clear and consistent federal reprocessing policy will permit domestic uranium producers to effectively plan production schedules into the future.

2. URANIUM SUPPLY

At today's consumption level, the United States reserve and resource base is large enough to support the needs of the nuclear power industry for approximately 300 years. For projected 1990 consumption levels, there is sufficient uranium to support nuclear power generation for over 100 years.

a. Reserves and Resources

Current DOE estimates of domestic reserves and resources are shown in Table IV-4. They are categorized by "forward cost" categories, a DOE term used to describe "the operating and capital costs, in present dollars that would be incurred in production of the uranium. These include the costs of power, labor, materials, royalties, payroll and production taxes, insurance, and applicable general and administrative costs. All previous expenditures (before the time of the estimate) for such items as property acquisition, exploration, mine development, mill construction, etc., are excluded. Also excluded are income taxes, profit, and the cost of money."

In order to calculate the price required to cover those excluded costs as well as provide for a reasonable return on investment, uranium analysts commonly multiply forward costs by a factor of 1.5 to 2.0. Thus, as the market price for uranium rises or drops, so does the reserve and resource base which could be developed economically. For example,

TABLE IV-4

U.S. URANIUM RESERVES AND RESOURCES
(tons U_3O_8 x 1000)

$/pound U_3O_8 Forward Cost Category	Reserves	Resources			Total
		Probable	Possible	Speculative	
January 1980 Estimate					
<15	225	415	210	75	700
15 - 30	420	590	465	225	1,280
<30	645	1,005	675	300	1,980
30 - 50	291	500	495	250	1,245
<50	936	1,505	1,170	550	3,225
January 1981 Estimate					
<15	112	295	87	74	456
15 - 30	358	590	259	237	1,086
<30	470	885	346	311	1,542
30 - 50	317	541	295	171	1,007
<50	787	1,426	641	482	2,549

SOURCE: DOE.

NOTE: The 1979 and 1980 resource estimates were unchanged. The 1981 resource estimates reflect the October 1980 estimates and do not include the $100 category.

at today's market price of $23.50*, only uranium with less than $15 forward costs could be considered economic. If prices rise, then so would the exploitable resource base.

Comparing the changes in DOE reserve estimates from 1980 to 1981 also illustrates how the recent market has affected the U.S. producing industry. Note the significant drop in the $15, $30, and even $50 reserves, as well as in the same categories of resources. Table IV-5 summarizes the types of changes that have occurred, accounting not only for inflation but also for depletion caused by mining and additions from new discoveries. It is obvious that inflation represents the greatest source of attrition in cost categories.

Table IV-6 and Figure IV-3 indicate changes that have occurred historically in U.S. uranium reserves. The rate of depletion in low-cost categories is accelerating with the 50 percent reduction in $15 forward cost reserves during 1980, representing an all-time high. This deterioration of the domestic uranium reserve and resource base is indicative of the condition of the industry; incentives for finding new, low-cost deposits have vanished and, at the current rate, so will the existing deposits based on economics alone.

b. Exploration Activities

Uranium exploration activities in the United States have undergone several cycles. The last major upswing began in 1973 in response to a strong outlook for nuclear power and the accelerating demand for uranium. However, recent reductions in uranium demand and price, in combination with rising costs, have resulted in a significant reversal of the cycle. Since 1978, there has been a decrease in exploration activities, as shown in Figure IV-4. Total drilling dropped from 47 million feet in 1978, to 28 million feet in 1980. Accordingly, exploration expenditures have

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* The July 1981 NUEXCO exchange value (a commonly agreed to measure of spot market price).

TABLE IV-5

EXPLANATION OF CHANGES OCCURRING IN 1980 AND 1981 URANIUM RESERVES
(tons U_3O_8 x 1000)

	$15/lb.	$30/lb.	$50/lb.
1979 Reserves	290	690	138
• Additions	1	20	64
• Depletions	(14)	(19)	(20)
• Reductions due to Inflation	(52)	(46)	(28)
1980 Reserves	225	645	936
• Additions	0	1	13
• Depletions	(16)	(22)	(24)
• Reductions due to Inflation	(97)	(154)	(138)
1981 Reserves	112	470	487

SOURCE: DOE, June 1981.

TABLE IV-6

CHANGE IN $15 AND $30 DOMESTIC URANIUM RESERVES

	Reserves (tons U_3O_8 x 1000)		Percent Change	
	$15/lb.	$30/lb.	$15/lb.	$30/lb.
1971	391			
1972	520		33	
1973	520		0	
1974	520	634	0	
1975	420	600	(19)	(5)
1976	430	640	2	7
1977	410	680	(5)	6
1978	370	690	(10)	1
1979	290	690	(22)	0
1980	225	645	(22)	(6)
1981	112	470	(50)	(27)

SOURCE: DOE, June 1981.

FIGURE IV-3

HISTORICAL LEVELS OF US $15 AND $30 URANIUM RESERVES

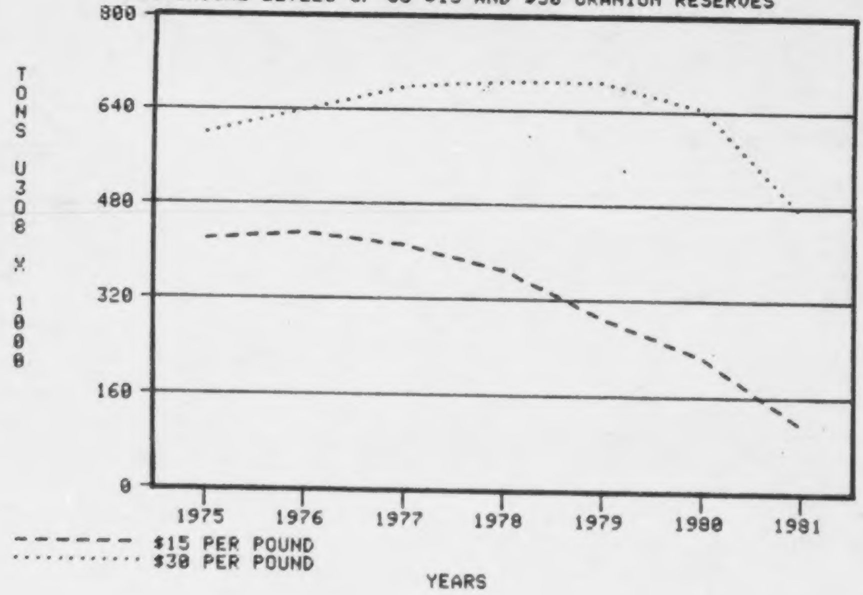
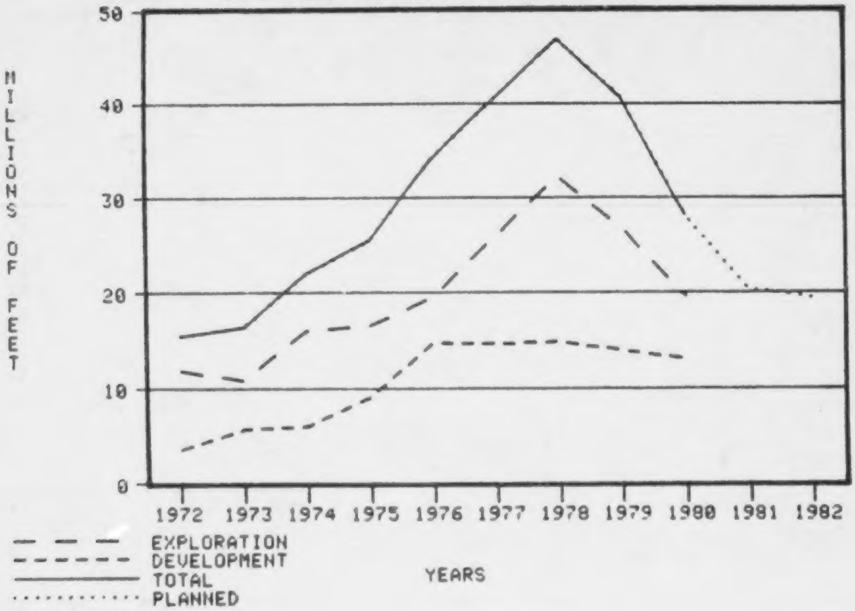


FIGURE IV-4

US EXPLORATION DRILLING FOR URANIUM



also decreased, as shown in Figure IV-5 and Table IV-7. Expressed in 1981 constant dollars, total exploration expenditures (which include not only drilling costs but also salaries and land acquisition) dropped from 457.3 million dollars in 1978 to 267.0 million dollars in 1980. Reductions in exploration activities and expenditures indicate that the current uranium-producing industry is not growing or developing to meet future needs. Due to the uncertain demand for new uranium production, the exploration segment of the industry continues to face a number of years of declining activity.

With an average lead time of 10 years required to discover and develop a deposit, reduced levels of exploration activity now will result in future production shortages.

c. Production Activities and Plans

The U.S. uranium-producing industry responded to the optimistic outlook for uranium in the early 1970's by significantly expanding production and plans for new facilities. (See Figure IV-6.) Many of the mines and mills planned during that period came into production in the late 1970's when it was becoming apparent that their capacity was not required by the market. Over the past 18 months many of these new mines, as well as older mines, have announced shutdowns or production cutbacks. However, due to the lag time involved between announced cutbacks and actual reductions in production, total production for 1980 actually increased to approximately 21.2 thousand tons. It is expected that 1981 production will be significantly lower.

Numerous mines that are still under construction have been placed on an indefinite "standby" status bringing estimates of future production to an all-time low. Table IV-8 reflects the declining NUKEM* estimates of production capability over a period of only six months. Table

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* NUKEM is a widely respected international brokerage and consulting firm for the nuclear industry.

FIGURE IV-5

US EXPLORATION EXPENDITURES (IN CONSTANT 1981 DOLLARS)

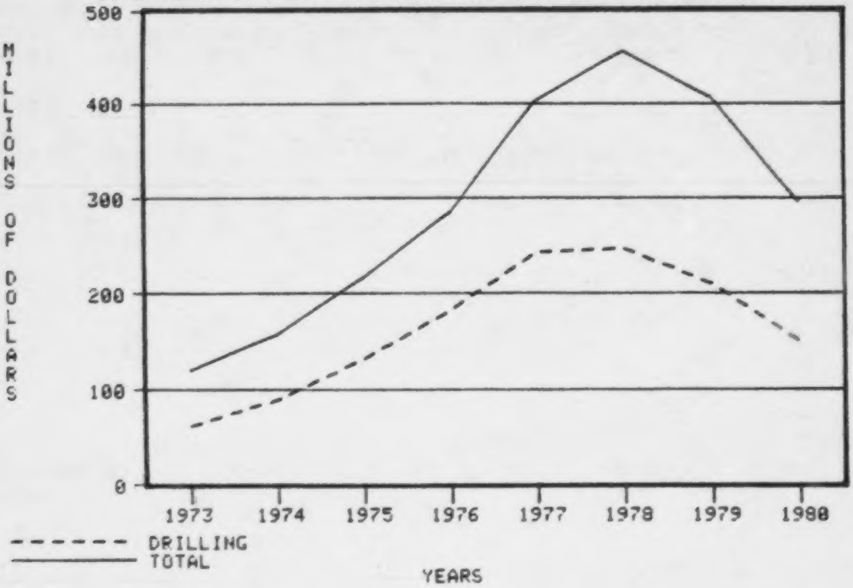


TABLE IV-7

EXPLORATION EXPENDITURES OF THE U.S. URANIUM INDUSTRY
(millions of current (constant*) dollars)

	Drilling Expenditures			Total Exploration** Expenditures
	Exploration	Development	Total	
1973	$ 19.5 (47.2)	$ 5.8(14.0)	$ 25.3 (61.2)	$ 49.5(119.8)
1974	34.9 (69.1)	9.8(19.4)	44.7 (88.6)	79.1(156.7)
1975	51.9 (92.2)	21.9(38.9)	73.8(131.1)	122.0(216.8)
1976	70.7(118.1)	38.3(64.0)	109.0(182.1)	170.7(285.2)
1977	99.4(155.3)	56.3(87.9)	155.7(243.2)	258.1(403.2)
1978	113.3(164.9)	56.4(82.1)	169.7(246.9)	314.3(457.3)
1979	119.6(154.0)	43.4(55.9)	163.0(209.9)	315.9(406.9)
1980	94.8 (94.8)	30.9(30.9)	135.7(135.7)	267.0(267.0)

* Expressed in 1981 dollars, as deflated by the Producer Price Index, All Industrial Commodities.

** Includes expenditures for land acquisition, drilling and all other costs directly associated with a company's uranium exploration effort.

SOURCE: DOE.

FIGURE IV-6

HISTORICAL US URANIUM PRODUCTION

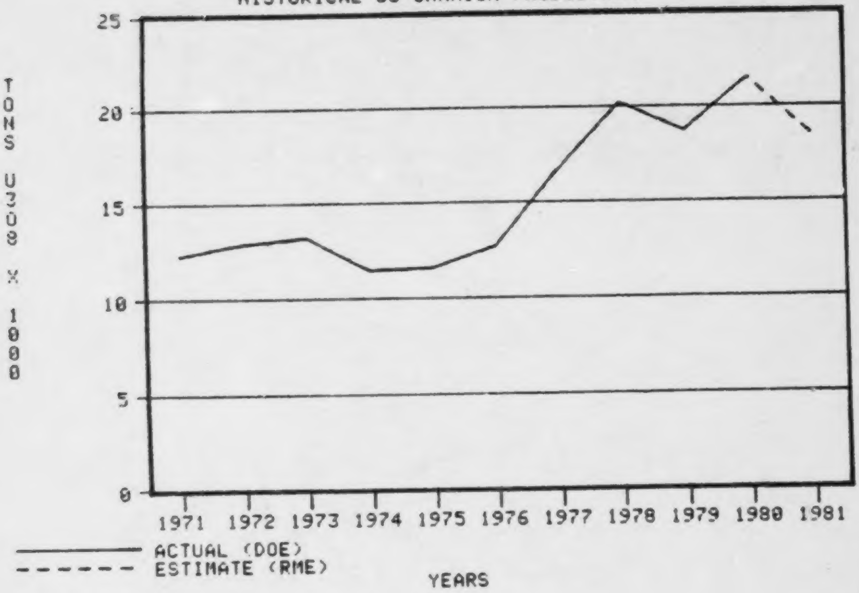


TABLE IV-8

COMPARISON OF NUKEM FORECASTS OF U.S. PRODUCTION CAPABILITIES
(tons U_3O_8 x 1000)

	Existing		Under Construction		Planned		Total		Net Change In Total	
	11/80	6/81	11/80	6/81	11/80	6/81	11/80	6/81	Amount	Percent
1981	19.7	19.5	2.3	1.4	0.3		22.3	20.9	1.4	(6)
1982	20.8	18.7	3.2	3.3	1.3		25.3	22.0	3.3	(13)
1983	20.2	17.1	3.9	4.1	4.0		26.1	21.2	6.9	(25)
1984	19.3	16.4	3.9	5.4	5.5		28.7	21.8	6.9	(24)
1985	19.5	15.1	4.1	6.9	5.1		28.7	22.0	6.7	(23)
1986	19.5	13.2	4.9	6.9	5.1	2.5	29.5	22.6	6.9	(23)
1987	18.5	11.3	4.9	5.9	5.1	5.8	28.5	23.0	5.5	(19)
1988	18.5	10.2	4.9	5.9	5.1	6.2	28.5	22.3	6.2	(22)
1989	18.0	8.8	4.9	5.9	5.1	6.2	28.0	20.9	7.1	(25)
1990	17.6	7.1	4.9	5.9	5.1	6.2	27.6	19.2	8.4	(30)

IV-9 combines current estimates of production capability according to project status with current sales commitments to indicate total uncommitted production capability. (See Figure IV-7.) In 1985 total uncommitted production capability will amount to 9.6 thousand tons and 12.2 thousand tons in 1990. However, given the current market conditions it is likely that none of the planned projects and few, if any, of those under construction will actually commence operations. Canceled or delayed new mines can usually be rescheduled for development within a reasonable time. Existing mines which have cut-back production or closed, however, have serious problems resuming former production levels. These operations must reconstruct a work force, rehabilitate, or purchase equipment, etc. While operations are suspended, state and federal regulations may require reclamation of mining operations and mill tailings ponds; these conditions would almost certainly preclude reopening of the operation.

Based on all projects under construction and planned projects actually going into production, Table IV-10 and Figure IV-8 summarize NUKEM projections of production by forward cost categories. The estimates are strikingly lower than those shown in the DOE report once again reflecting the accelerating deterioration of the industry. By 1990 only 2.0 thousand tons, or essentially one-third of production to become available from projects under construction, will be possible to produce at a cost under $30 per pound. (The DOE report suggests that as much as 15 thousand tons would be available at forward costs less than $30 per pound in 1990.)

As the domestic production capability diminishes, both in terms of the number of operating projects as well as in the context of the relative costs of production, foreign uranium will play an increasingly significant role in supplying fuel requirements for domestic power, thereby increasing the degree of U.S. dependency on foreign energy sources.

TABLE IV-9

PROJECTED U.S. PRODUCTION CAPABILITY
(tons U_3O_8 x 1000)

	A Existing Facilities	B Under Construction	A+B	C Planned Facilities	A+B+C	Total Sales Commitments*	Total Uncommitted Capacity
1981	19.5	1.4	20.9		20.9	19.8	1.1
1982	18.7	3.3	22.0		22.0	18.9	3.1
1983	17.1	4.1	21.2		21.2	17.4	3.8
1984	16.4	5.4	21.8		21.8	14.6	7.2
1985	15.1	6.9	22.0		22.0	12.4	9.6
1986	13.2	6.9	20.1	2.5	22.6	10.7	11.9
1987	11.3	5.9	17.2	5.8	23.0	9.3	13.7
1988	10.2	5.9	16.1	6.2	22.3	8.6	13.7
1989	8.8	5.9	14.7	6.2	20.9	8.1	12.8
1990	7.1	5.9	13.0	6.2	19.2	7.0	12.2

* DOE, June 1981 (includes exports).

SOURCE: NUKEM, June 1981.

FIGURE IV-7

PROJECTED US PRODUCTION CAPABILITY

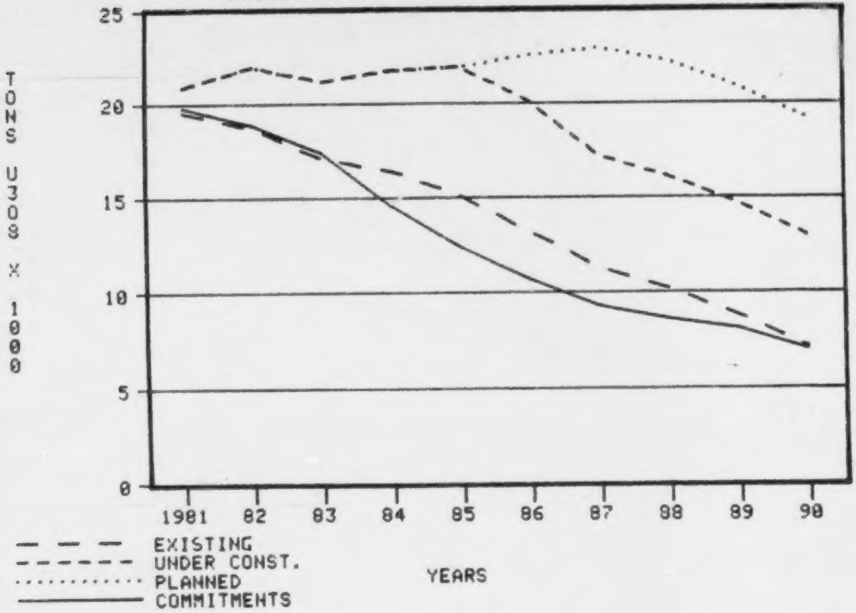


TABLE IV-10

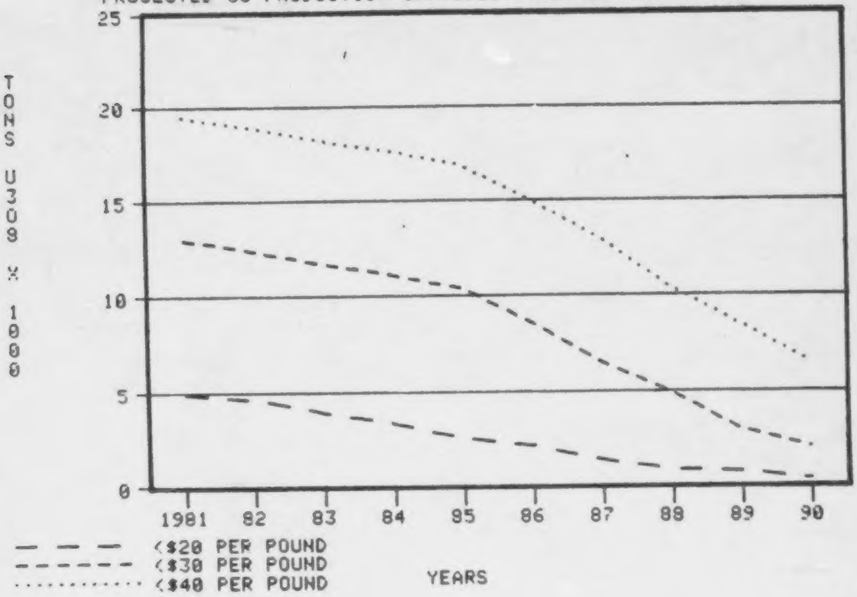
PROJECTED U.S. PRODUCTION CAPABILITY BY COST CATEGORY
(tons U_3O_8 x 1000)

	$20/pound	$30/pound	$40/pound
1981	4.9	13.0	19.5
1982	4.6	12.4	18.9
1983	3.9	11.7	18.2
1984	3.3	11.1	17.6
1985	2.5	10.4	16.9
1986	2.1	8.6	15.0
1987	1.3	6.5	13.0
1988	0.8	4.9	10.4
1989	0.7	2.9	8.5
1990	0.3	2.0	6.5

SOURCE: NUKEM, June 1981.

FIGURE IV-8

PROJECTED US PRODUCTION CAPABILITY (BY COST CATAGORY)



d. Utility Inventories

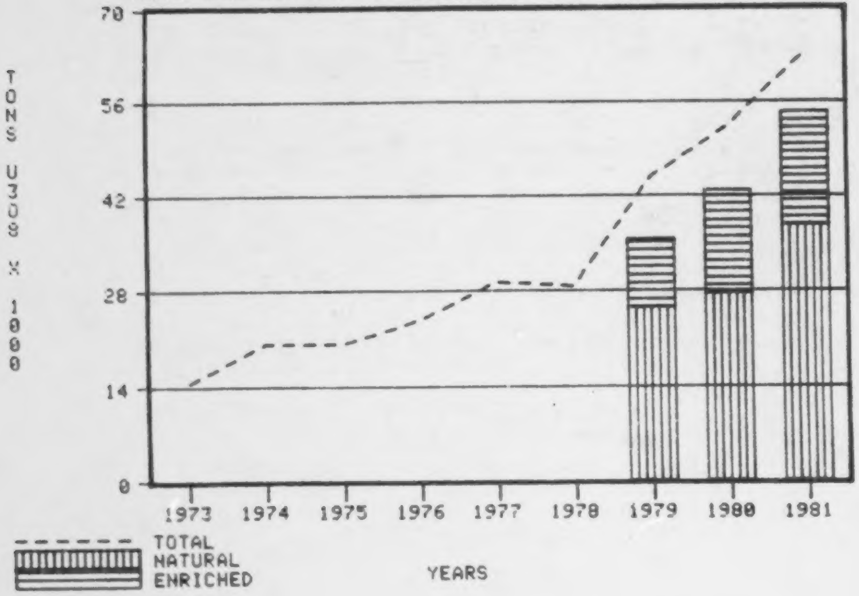
Uranium inventories have been increasing steadily as production has consistantly exceeded requirements in recent years. Figure IV-9 shows the increasing buildup of total inventories to a level of 63.4 thousand tons for 1981, a 21 percent increase of the 1980 level of 52.3 thousand tons. Figure IV-9 illustrates the relative proportions of natural and enriched uranium held by utilities, which excludes that held by producers, reactor manufacturers and fuel fabricators and, therefore, provides a better indication of what may become available in the market. The total amount held by utilities in 1980 increased from 42.8 to 54.4 thousand tons in 1981. Most of that increase consists of natural uranium reflecting the effects of the peak 1980 level of uranium production.

The utility-held level of 54.4 thousand tons represents 3.8 years of forward coverage assuming fuel requirements of 14.4 thousand tons in 1981. Utilities generally prefer to maintain a maximum of 1½ to 2 years of forward coverage in order to avoid substantial carrying costs.

Utilities have been reacting to large inventories in three ways: (1) selling some of their inventories; (2) delaying or canceling contracts for additional deliveries (which would increase inventories even further); and, (3) delaying decisions about future contracting until current inventories are reduced. The drop in the spot market price over the past year has been largely the result of lack of buyers in the marketplace (i.e., a "soft" or "buyers" market) and, when sales did occur, they were often the sale of inventory by the utilities. The drop in contracting activity discussed earlier has also been generally a result of utility inventory management policies.

FIGURE IV-9

HISTORICAL BUILD-UP OF US URANIUM INVENTORY LEVELS



3. URANIUM MARKETING ACTIVITIES

a. Contracting

The viability of the uranium industry can be reflected in the absolute and relative level of new contracting activity occurring in the marketplace. Contracting is a highly diagnostic feature of uranium industry viability (i.e., the growth and development of the industry). Long-term commitments between domestic producers and domestic buyers actually decreased during 1980 representing the first time in recent history that buyers have actually backed out of purchase commitments. Table IV-11 compares the years in which the commitments were made (purchase years) with the years for which the commitments were made (commitment years). Since 1976, amounts of contracted uranium have increased for each of the commitment years until 1981. The total 1981 amount of 118.3 thousand tons represents a 14 percent decrease from the 1980 level of 137.1 thousand tons. (See Figure IV-10.)

A corresponding decrease of activity has occurred in the spot market. Not only have sales volumes dropped off dramatically, but the sales price has also dropped accordingly. Table IV-12 and Figure IV-11 illustrate the historical trend of the NUEXCO exchange value, a commonly agreed upon measure of the spot market price.

b. Procurement of Foreign Uranium

The percentage of foreign uranium delivered to the DOE enrichment facilities has grown since 1977 although the actual amounts decreased concurrently with the domestic share in 1980. Table IV-13 indicates that foreign uranium represents 4.7 percent of total deliveries in 1977, and 10 percent in 1980. A total of 16 utilities out of the 46 toll enrichment customers utilized foreign feed which constituted 23 percent of their deliveries. Eight of the 16 utilities used the maximum 30 percent.

TABLE IV-11

HISTORICAL DOMESTIC PURCHASE COMMITMENTS TO DOMESTIC PRODUCERS

(tons U_3O_8 x 1000)

Commitment Year	Purchase Year (January)					
	1976	1977	1978	1979	1980	1981
1981	11.8	19.0	19.6	19.3	20.5	18.0
1982	10.5	19.2	19.5	19.4	19.4	17.5
1983	8.3	15.0	17.0	17.8	17.4	15.9
1984	5.7	13.0	13.0	14.1	16.0	13.9
1985	4.3	11.5	11.7	12.8	13.9	11.7
1986	1.9	8.4	9.1	10.9	11.2	10.1
1987	1.4	7.2	8.8	10.5	11.4	8.7
1988	1.1	6.4	7.9	9.5	10.5	8.0
1989	1.1	6.4	7.5	9.4	9.5	7.8
1990	0.5	5.2	6.4	7.3	7.3	6.7
TOTAL	46.6	111.3	120.5	131.0	137.1	118.3

SOURCE: DOE.

FIGURE IV-10

HISTORICAL US COMMITMENTS FOR 1981,1984 AND 1987

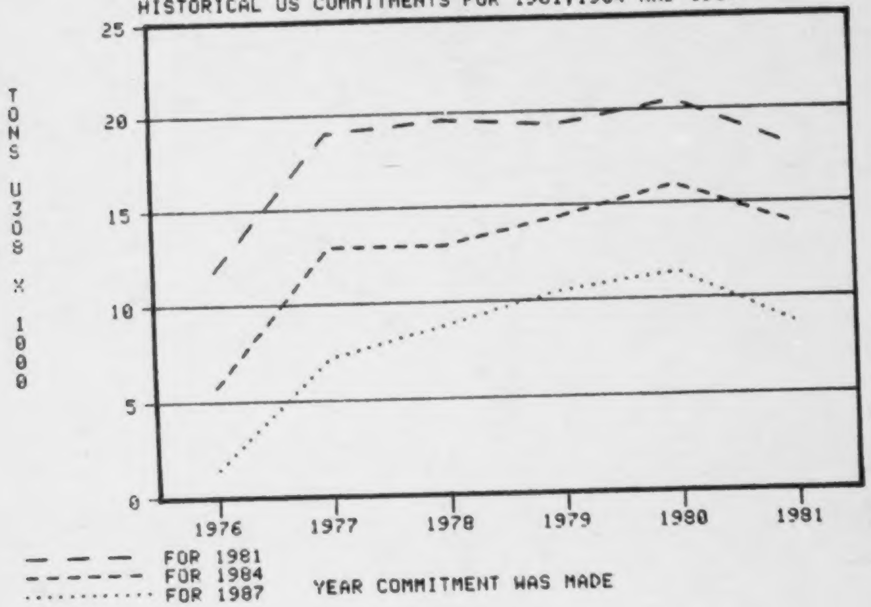


TABLE IV-12

HISTORICAL NUEXCO PRICES

	Current Dollar Price* (dollars per pound)	Constant Dollar Price** (dollars per pound)
1971	6.20	16.55
1972	5.95	15.37
1973	5.95	14.40
1974	7.70	15.25
1975	16.00	28.43
1976	35.20	58.82
1977	41.35	64.59
1978	42.90	62.42
1979	43.25	55.71
1980	40.00	44.40
1981	23.50***	23.50***

* Represents the NUEXCO Exchange Value on January 31 of each year shown.

** Represents constant dollars based on June 1981 Producer Price Index for Industrial Commodities.

*** As of July 1981.

SOURCE: NUEXCO.

FIGURE IV-11

HISTORICAL NUEXCO PRICE

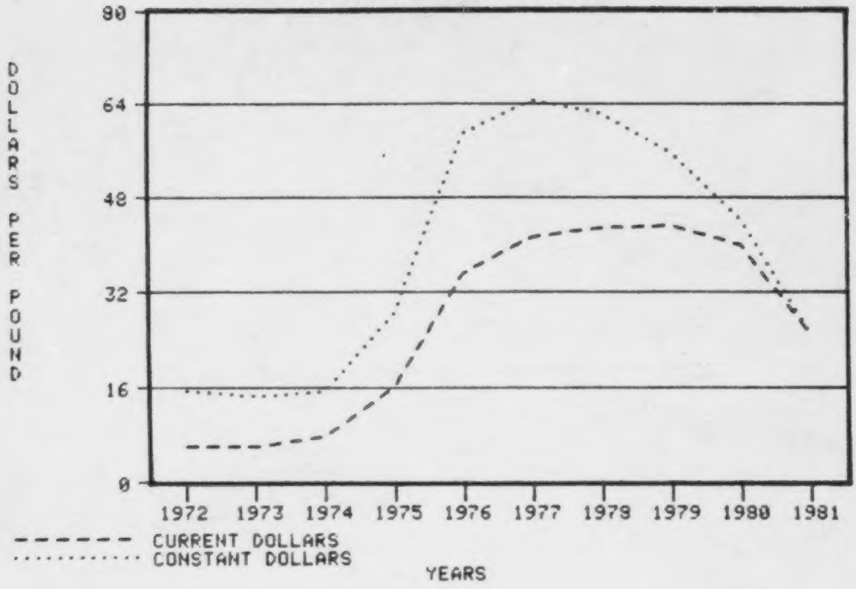


TABLE IV-13

DELIVERIES OF URANIUM TO DOE BY DOMESTIC URANIUM ENRICHMENT CUSTOMERS

	ORIGIN (tons U_3O_8)			Percent Foreign	
Year	U.S.	Foreign	Total	Actual	Allowable
1977	14,240	703	14,943	4.7	10
1978	11,957	728	12,685	5.7	15
1979	15,436	1,591	17,027	9.3	20
1980	11,135	1,241	12,376	10.0	30

SOURCE: DOE, June 1981.

Actual deliveries and new commitments of uranium imports can be seen in Table IV-14. Through 1979, both commitments and actual deliveries are relatively lower than earlier years. However, it should be noted that a significant new commitment was made in 1980 accounting for 2.25 of the 2.30 thousand tons for that year. The contract was between American Electric Power and Energy Resources of Australia. The uranium will be produced from the new Ranger Project which is scheduled for operation in October of this year. The average cost of production at Ranger is projected to be less than $15 per pound.

It was recently announced in Nuclear Fuel, August 17, 1981, that two long-term uranium contracts between a Canadian producer and two U.S. utilities are awaiting Canadian government approval. The uranium will come from the Uranerz Exploration and Mining Ltd. share of the Key Lake Project in Saskatchewan. The article points out that the sales "...are viewed as a commercial breakthrough because they are, according to several sources, the first involving long-term commitments with U.S. utilities in more than a year, and because they represent the beginning of an anticipated flood of uranium from the new western Canadian deposits to the U.S." (emphasis added).

4. EMPLOYMENT

A recent uranium employment survey completed by Rocky Mountain Energy in August 1981 indicates that employment in uranium operations (excluding exploration) has decreased 43 percent since January 1980, and 33 percent since January 1981. Some of the companies surveyed which had not laid-off operating personnel were able to retain existing levels as a result of long-term contractual agreements. Most of the companies, however, actually laid-off employees or reduced the work force through attrition.

As of January 1, 1980, approximately 8,700 people were employed in uranium exploration and 6,400 were employed as of August 1981; this represents a 26 percent decline within 20 months.

Most of the companies surveyed indicated that they expect moderate to extreme difficulty in attracting

TABLE IV-14

HISTORICAL CONTRACTING BY U.S. BUYERS FOR FOREIGN URANIUM

(tons U_3O_8 x 1000)

	New Commitments		Actual Deliveries
Year	Number	Amount	(Amount)
1970	1	2.1	0
1971	0	0	0
1972	2	7.7	0
1973	1	1.1	0
1974	2	10.6	0
1975	5	4.6	0.7
1976	2	0.5	1.8
1977	2	1.5	2.8
1978	2	0.5	2.6
1979	1	0.8	1.5
1980	2	2.3	1.8
TOTAL	19	31.7	11.2

SOURCE: DOE, June 1981.

skilled workers when production begins again or is increased to normal capacity. The degree of expected difficulty in attracting skilled labor back to work depends primarily on the timing of the turn-around in the uranium market. The ability of domestic uranium producers to rehire skilled workers will be more severely impacted if a turn-around is not seen within a couple of years because more and more workers will find new jobs and careers.

B. Foreign Uranium Industry

• Summary

Unlimited foreign uranium imports will significantly affect the viability of the domestic uranium industry. The current and projected foreign supply/demand imbalance will have a major effect on the domestic uranium industry. In order to maintain a viable domestic uranium industry, pursuant to the Atomic Energy Act of 1954, Sec. 161(v), Rocky Mountain Energy believes the Department of Energy should immediately amend its uranium enrichment criteria to establish a 20 percent annual limitation on the amount of foreign uranium a domestic utility could enrich for domestic end-use. This enrichment limitation should become effective after the statute-required review by Congress, and remain in effect until the year 2000, or until such time as the Department of Energy properly determines the viability of the domestic uranium industry will be maintained with no restriction on the use of foreign uranium for domestic end-use.

1. Foreign Nuclear Power and Foreign Reactor Requirements for Uranium

Nuclear capacity and uranium demand have been forecast by DOE for the "World Outside Communist Areas" (WOCA). Installed capacity for the non-U.S. portion of WOCA is projected to increase from the current 75 GWe level to between 165 and 201 GWe in 1990, and 300 to 400 GWe in 2000. (Table IV-15.) The 1990 projected foreign reactor requirements* for uranium are 27.5 to 32.7 thousand tons of U_3O_8. (Table IV-16.)

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* Assumes a 0.20 percent enrichment tails assay. If the tails assay increases, so will the uranium required to support the same level of nuclear capacity; likewise, a lower tails assay will lower uranium requirements.

TABLE IV-15

1980 PROJECTED NON-U.S. WOCA* INSTALLED NUCLEAR CAPACITY

(GWe)

	Low	High
1985	117	128
1990	165	201
1995	229	280
2000	300	400

* World Outside Communist Area.

SOURCE: DOE, (EIA, 1980).

TABLE IV-16

PROJECTED NON-U.S. WOCA* REACTOR REQUIREMENTS FOR URANIUM
(tons U_3O_8 x 1000)

	Low	Mid	High
1981	19.2	20.2	20.0
1982	19.7	21.6	21.2
1983	21.6	23.2	23.6
1984	23.5	24.4	26.1
1985	24.0	26.2	29.2
1987	24.5	28.0	30.4
1988	27.0	29.7	32.7
1989	26.3	29.9	32.5
1990	27.5	31.6	32.7

* World Outside Communist Area.

SOURCE: DOE, (EIA, 1980).

2. Foreign Uranium Supply

The foreign uranium resource base is extremely large. With major new discoveries made during the 1970's in Australia and Canada, the already large foreign uranium supply could be substantially increased. (Table IV-17.)

In direct contrast to the U.S. uranium resource base, a significant portion of foreign uranium is in the lower forward cost categories and can effectively be produced and sold for reduced prices. As additional exploration and development occurs in Canada and Australia, the lower-cost foreign resource base will expand.

3. Future Production Capability

Projections of non-U.S. WOCA production capability by forward cost categories are shown in Table IV-18 and Figure IV-12. In 1990 almost 18 thousand tons of uranium could be produced at a cost of less than $20 per pound; 30 thousand tons at less than $30 per pound, and 40 thousand tons at less than $40 per pound. In each cost category potential production actually increases over the decade. The projections are in sharp contrast to similar ones for the United States (see Table IV-10). In 1990 the U.S. will only be able to produce 6.5 thousand tons at a cost of less than $40 per pound if no new deposits are discovered.

In spite of the current oversupply of uranium in the world market, plans for new, low-cost production centers are still firm, presumably with the hope of displacing existing, higher-cost production centers. Projections of production capability for existing, under construction and planned facilities are shown for Canada in Table IV-19 and Figure IV-13, Australia in Table IV-20 and Figure IV-14, and South Africa in Table IV-21 and Figure IV-15. Currently-existing sales commitments are also shown to illustrate the remaining amount of uncommitted capability that is currently being marketed in the United States. Table IV-22 summarizes the amounts of uncommitted production capability for each country by year. Australia and Canada together could supply a total of 15.4 thousand tons of uranium to the U.S., an amount which actually exceeds domestic unfilled requirements of only 11.6 thousand tons by 1990.

TABLE IV-17

REASONABLY ASSURED URANIUM RESOURCES FOR THE WESTERN WORLD

(below $25 per pound)

Country	Tons U_3O_8 x 1000	Percent of Total
Australia	456	29
United States	349	22
Canada	298	19
South Africa	266	16
Namibia	99	6
Niger	79	5
Gabon	26	2
France	21	1
TOTAL	1,594	100

SOURCE: NUEXCO, July 1981.

TABLE IV-18

PROJECTED NON-U.S. WOCA PRODUCTION CAPABILITY BY FORWARD COST CATEGORIES

(tons U_3O_8 x 1000)

	$20/pound	$30/pound	$40/pound
1981	13.3	27.3	35.1
1982	14.9	28.6	37.0
1983	16.9	29.8	39.0
1984	17.5	30.5	42.2
1985	18.6	31.2	41.6
1986	19.0	31.7	42.2
1987	19.5	32.5	41.6
1988	19.7	31.5	41.6
1989	18.8	30.9	40.9
1990	17.9	30.5	40.3

SOURCE: NUKEM, June 1981.

FIGURE IV-12

NON US WOCA PRODUCTION CAPABILITY (BY COST CATAGORY)

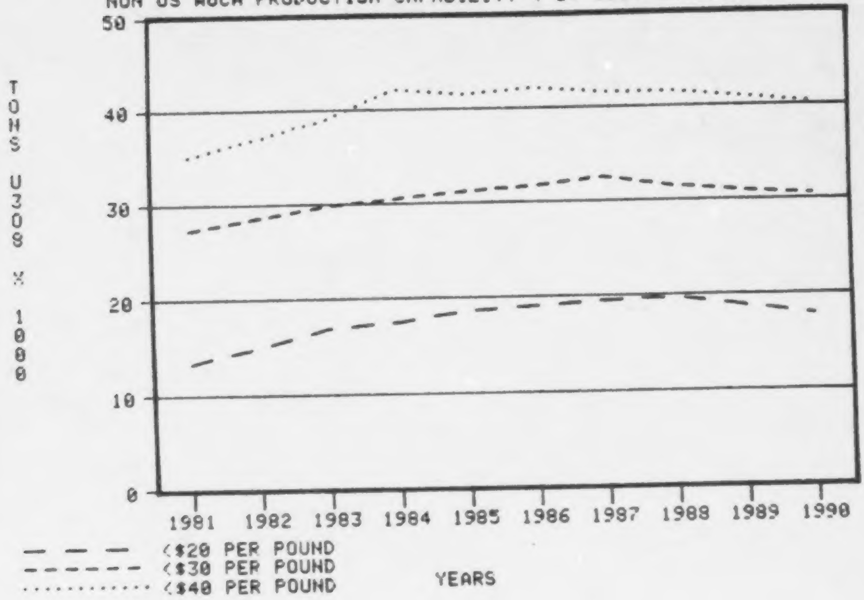

TABLE IV-19

PROJECTED CANADIAN PRODUCTION CAPABILITY
(tons U_3O_8 x 1000)

	A Existing Facilities	B Under Construction	A + B	C Planned Facilities	A + B + C	Total Sales Commitments
1981	11.4		11.4		11.4	11.4
1982	12.1		12.1		12.1	12.3
1983	12.1		12.1		12.1	12.0
1984	12.1	.2	12.3	2.0	14.3	12.0
1985	12.1	1.0	13.1	4.0	17.1	11.7
1986	9.6	3.5	13.1	4.0	17.1	11.2
1987	9.5	3.5	13.0	6.0	19.0	11.0
1988	9.3	3.5	12.8	7.0	19.8	10.4
1989	9.3	3.5	12.8	7.0	19.8	10.4
1990	9.3	3.5	12.8	7.0	19.8	10.4

SOURCE: NUKEM, June 1981.

FIGURE IV-13

PROJECTED CANADIAN PRODUCTION CAPABILITY

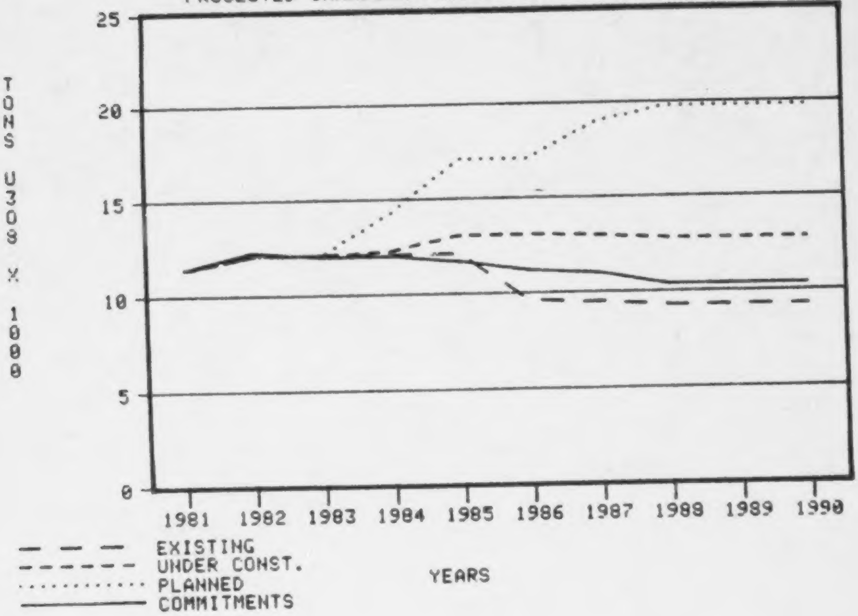

TABLE IV-20

PROJECTED AUSTRALIAN PRODUCTION CAPABILITY
(tons U_3O_8 x 1000)

	A Existing Facilities	B Under Construction	A + B	C Planned Facilities	A + B + C	Total Sales Commitments
1981	2.6	.3	2.9		2.9	2.9
1982	2.6	3.0	5.6		5.6	5.6
1983	2.5	3.3	5.8		5.8	5.8
1984	2.5	3.3	5.8		5.8	5.8
1985	1.7	3.3	5.0		5.0	5.0
1986	1.7	3.3	5.0	1.6	6.6	5.0
1987	1.7	3.3	5.0	4.3	9.3	5.0
1988	1.7	3.3	5.0	6.0	11.0	5.0
1989		3.3	3.3	6.0	9.3	3.3
1990		3.3	3.3	6.0	9.3	3.3

SOURCE: NUKEM, June 1981.

FIGURE IV-14

PROJECTED AUSTRALIAN PRODUCTION

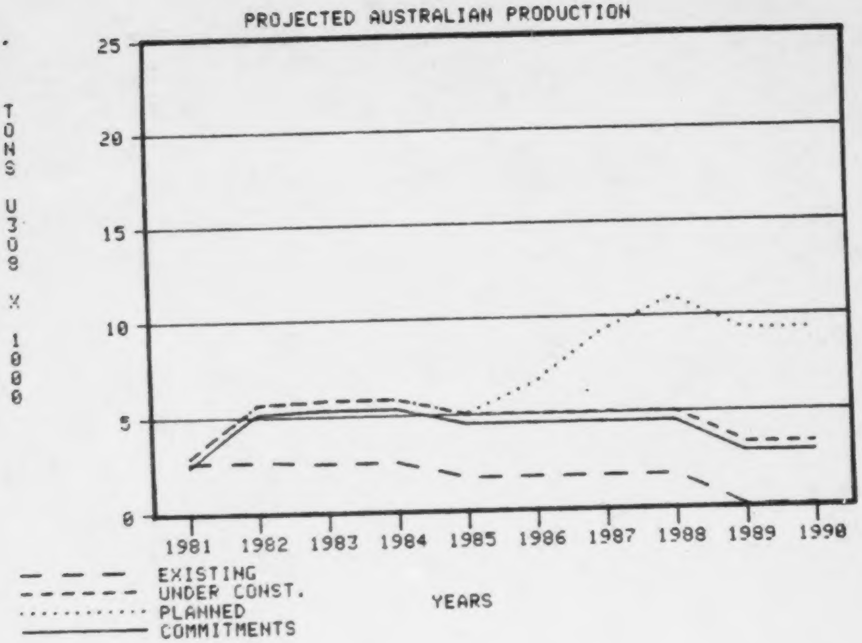

TABLE IV-21

PROJECTED SOUTH AFRICA PRODUCTION CAPABILITIES
(tons U_3O_8 x 1000)

	A Existing Facilities	B Total Sales Commitments	A - B Uncommitted Production Capability
1981	7.8	6.7	1.1
1982	7.9	5.7	2.2
1983	7.9	5.8	2.1
1984	8.0	6.9	1.1
1985	8.2	6.0	2.2
1986	8.2	3.2	5.0
1987	8.2	2.6	5.6
1988	8.2	2.6	5.6
1989	8.2	1.6	6.6
1990	8.2	1.0	7.2

SOURCE: NUKEM, June 1981.

FIGURE IV-15

PROJECTED SOUTH AFRICAN PRODUCTION CAPABILITY

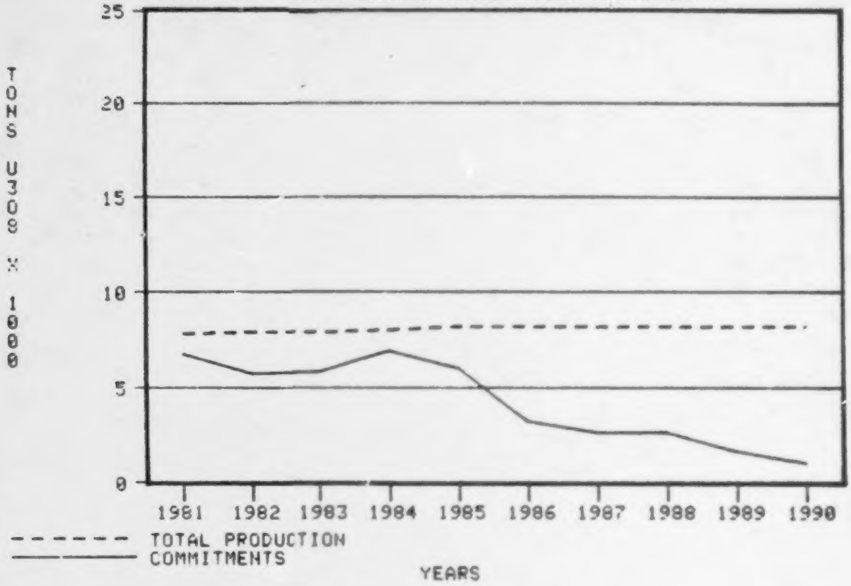

TABLE IV-22

TOTAL, UNCOMMITTED PRODUCTION CAPABILITY FROM CANADA, AUSTRALIA AND SOUTH AFRICA

(tons U_3O_8 x 1000)

	A Canada	B Australia	A + B	C South Africa	Total
1987				1.1	1.1
1982	0.2			2.2	2.4
1983	0.1			2.1	2.2
1984	2.3			1.1	3.4
1985	5.4			2.2	7.6
1986	5.9	1.6	7.5	5.0	12.5
1987	8.0	4.3	12.3	5.6	17.9
1988	9.4	6.0	15.4	5.6	21.0
1989	9.4	6.0	15.4	6.6	22.0
1990	9.4	6.0	15.4	7.2	22.6

C. Uranium Market Outlook

- Summary

Foreign uranium production and potential sales within the United States can seriously impact the domestic uranium industry unless reasonable limitations exist on the importation of foreign uranium. A large oversupply of low-cost foreign uranium could become available on the international market. In addition, most of the new and planned foreign mines will produce significantly lower-cost uranium than existing or planned U.S. mines. Foreign uranium could well absorb most, if not all, of the real U.S. uranium demand expected to occur once domestic utilities reduce excess uranium inventories. An even greater threat to the viability of the domestic uranium industry is the potential displacement by foreign producers of the current domestic uranium market through the attractiveness of existing, extremely low-cost/low-priced, foreign uranium.

Technology Review recently published a world uranium assessment report which stated:

> "The international uranium market will offer supplies in substantial excess of demand at least through the 1980's and probably well beyond, challenging the viability of the U.S. uranium industry and many countries' non-proliferation policies." (Technology Review, January 1981, page 19. Emphasis added.)

The world uranium assessment also indicated that if nuclear power continued on its current path of very modest growth, then there would be a continuing downward pressure on prices over the next decade.

1. SUPPLY AND DEMAND BALANCE

a. Domestic Market

A scenario projecting the aggregate supply and demand balance for the U.S. may be developed by combining the 1981 utility-held inventory level with comparisons of reactor requirements against current purchase commitments as shown in Table IV-23. If reactor schedules remain as currently planned and no further purchases of uranium are made, utility-held inventories will continue to build through 1982 to a peak of 62.2 thousand tons and then would begin a gradual depletion to the point where actual fuel deficits would occur. "Forward Years" represent the amount of years of supply the cumulative inventory level would provide based on requirements in the following year. Generally speaking, domestic utilities prefer carrying no more than 1½ to 2 years worth of inventories. It is, therefore, possible to suggest that new contracting would be needed between 1985 and 1986 in order to maintain the desired inventory levels.

However, such an analysis only provides an aggregate perspective which does not account for the relatively uneven distribution of inventories. Nuclear Resources International has conducted a domestic utility survey for DOE (June 1981) which indicates unfilled U.S. requirements actually occur as soon as 1983. (See Table IV-24.)

b. Foreign Market

In sharp contrast to the domestic market outlook of a relatively near-term recovery, the foreign market, as an aggregate, shows no indication of further contracting needs at least through 1990. A similar scenario may be constructed to project the aggregate supply and demand balance for the non-U.S. WOCA* countries. The projection, shown in Table IV-25, shows that the inventory level of 92.6 thousand tons is relatively higher than the U.S. level, representing 4.6 forward years of coverage as opposed to the 3.8 forward years for the U.S. in 1981. The inventories continue to build through 1989 reaching a peak level of 209.8 thousand tons of uranium or 6.6 years of forward coverage. Figure IV-16 compares the buildup of U.S. and foreign inventories. Figure IV-17 shows the corresponding years of forward coverage reflected in the inventory levels.

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* World Outside Communist Area.

TABLE IV-23

U.S. SUPPLY AND DEMAND BALANCE
(tons U_3O_8 x 1000)

	U.S. Mid Case Reactor Requirements*	U.S. Purchase Commitments**	Utility-Owned Inventories		Forward Years Coverage
			Annual	Cumulative	
1980				54.5	3.8
1981	14.4	19.9	5.5	60.0	3.5
1982	17.1	19.3	2.2	62.2	3.3
1983	18.9	17.7	(1.2)	61.0	3.1
1984	19.9	16.0	(3.9)	57.1	2.6
1985	21.9	13.8	(8.1)	49.0	2.0
1986	24.5	11.4	(13.1)	35.9	1.5
1987	24.2	9.9	(14.3)	21.6	0.9
1988	24.9	9.2	(15.7)	5.9	0.2
1989	24.9	9.0	(15.9)	(10.0)	(0.4)
1990	26.2	7.9	(18.3)	(28.3)	--

* DOE, June 1981.

** DOE, June 1981 (includes imports).

TABLE IV-24

U.S. UNFILLED REQUIREMENTS
(tons U_3O_8 x 1000)

Year	Amount
1981	
1982	
1983	0.9
1984	1.6
1985	4.2
1986	5.6
1987	8.4
1988	10.3
1989	9.5
1990	11.6

SOURCE: Nuclear Resources International, June 1981, (a report for DOE).

TABLE IV-25

NON-U.S. WOCA SUPPLY AND DEMAND BALANCE
(tons U_3O_8 x 1000)

	Mid Case Reactor Requirements*	Purchase** Commitments	Inventories		Forward Years Coverage
			Annual	Cumulative	
1980				92.6***	4.6
1981	20.2	37.3	17.1	109.7	5.1
1982	21.6	40.5	18.9	128.6	5.5
1983	23.2	40.8	17.6	146.2	6.0
1984	24.4	42.5	18.1	164.3	6.2
1985	26.2	43.4	17.2	181.5	6.5
1986	28.0	40.6	12.6	194.1	6.6
1987	29.2	36.9	7.7	201.8	6.8
1988	29.7	36.3	6.6	208.4	7.0
1989	29.9	31.3	1.4	209.8	6.6
1990	31.6	28.5	(3.1)	206.7	6.3

* EIA, October 1980.

** NUKEM, June 1981.

*** NUEXCO, July 1981.

FIGURE IV-16

PROJECTED URANIUM INVENTORIES

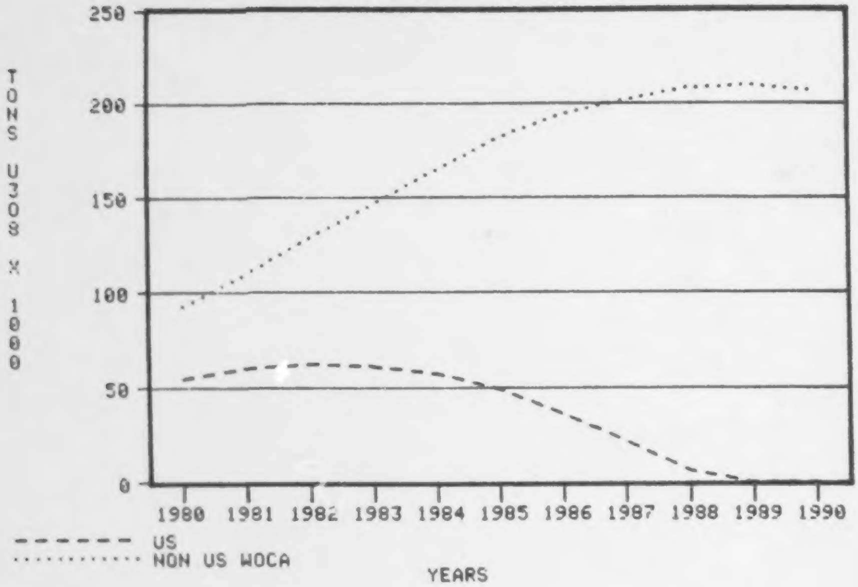
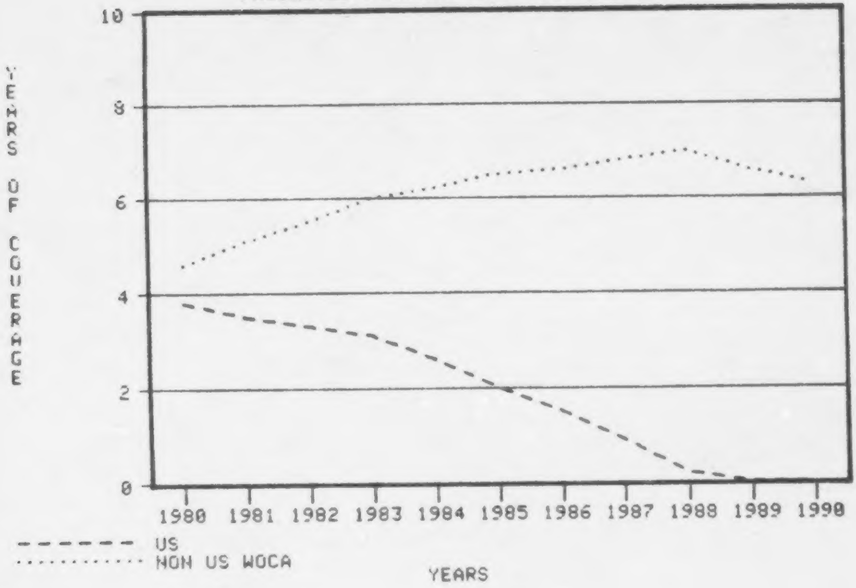


FIGURE IV-17

PROJECTED FORWARD YEARS COVERAGE



It should be emphasized that an aggregate perspective such as this does not reveal specific variations by either country or utility. It should also be realized that European countries, and especially Japan, prefer to hold more abundant inventories. However, it is obvious that the U.S. represents the primary source of potential demand, at least for the next decade.

2. FOREIGN URANIUM IMPACT

a. Future Import Levels and Effects

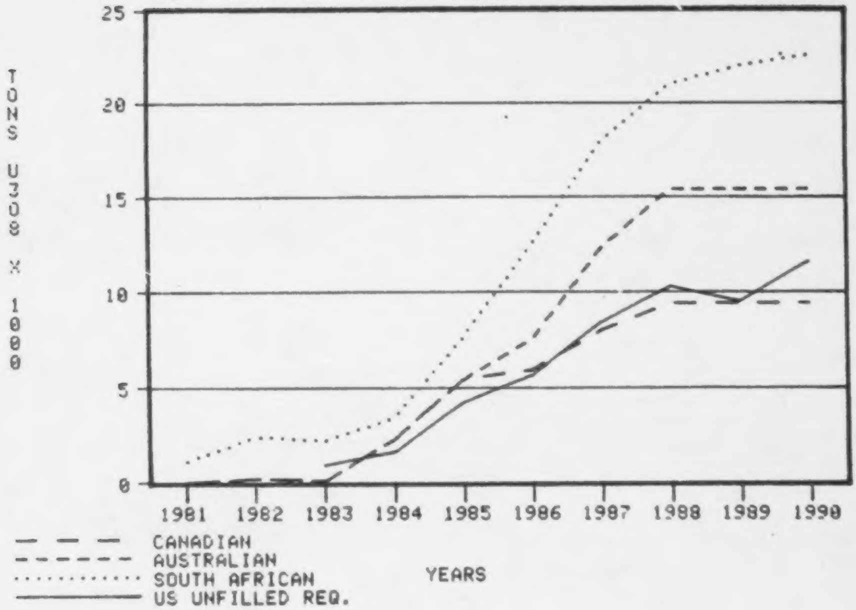
Current import commitments by U.S. utilities are relatively low. As new, low-cost foreign uranium becomes available, an increasing share of the U.S. requirements could be filled by foreign supply. Because of the current worldwide, oversupply condition, significant amounts of new material will not be needed until 1985. Beyond that time, it appears likely that imports to the U.S. will increase from the current 10 percent to a range from 30 to 60 percent by 1990.

The Nuclear Resources International report on "Domestic Utility Attitudes Toward Foreign Uranium" contains a compilation of utility estimates on anticipated foreign uranium procurement as well as reported unfilled requirements which are discussed in the preceeding section on supply and demand balance. (See Table IV-24.) The results of the survey indicate that on an aggregate, weighted average basis, utilities expect to cover approximately 30 percent of their total requirements with foreign uranium by 1990 and up to 35 percent by 2000. However, preferences regarding foreign uranium are changing rapidly as plans for new, highly attractive, low-cost production begin to materialize. Strict exporting guidelines, that have been maintained by foreign governments in the past, are already beginning to soften and government price controls are likely to become flexible as the market price continues to drop.

In the preceeding section, proposed schedules of production from Canada, Australia and South Africa revealed significant levels of currently uncommitted capability. Figure IV-18

FIGURE IV-18

UNCOMMITED NON US WOCA PRODUCTION CAPABILITY



demonstrates production available from Canada alone could supply almost all unfilled U.S. requirements through 1990. Therefore, even if Canada only sells half of its planned uncommitted production and Australia sells slightly more than half of its future production to the U.S., all hopes of a market recovery before 1990 for domestic producers would vanish.

Additional comparisons of projected foreign and domestic production by forward cost categories reveal the growing abundance of low cost foreign uranium compared to the shrinking domestic low-cost uranium resource base as shown in Figure IV-19.

To estimate the maximum penetration of foreign uranium into the domestic market during the next decade, a projection of real "demand" must be made and then compared to the combination of existing import commitments added to unfilled requirements. Table IV-26 shows how, by combining existing U.S. commitments to domestic and foreign producers with unfilled requirements, total "demand" can be determined. Note that the amounts by year are higher than actual reactor requirements in the early 1980's and then fall considerably lower than requirements in the 1980's. This discrepancy reveals the effects of overly-ambitious contracting for the earlier years and the consequences of high inventories and anticipation of further delays in reactors in the later years.

Table IV-27 shows the maximum levels of imports and corresponding percentage of "demand." Under existing commitments, the foreign share actually drops from the 10 percent level in 1981 to 6 percent by 1990. In the worst possible case, if all unfilled requirements are supplied by foreign uranium, the 10 percent foreign share in 1981 will soar to 66 percent by 1990.

This projection coincides with recent NUEXCO estimates as indicated by NUEXCO president, J. R. Wolcott, in a presentation to a General Electric conference on May 1, 1981. In it, he states:

FIGURE IV-19

COMPARISON OF US AND FOREIGN PRODUCTION CAPABILITY AT <$20 PER POUND

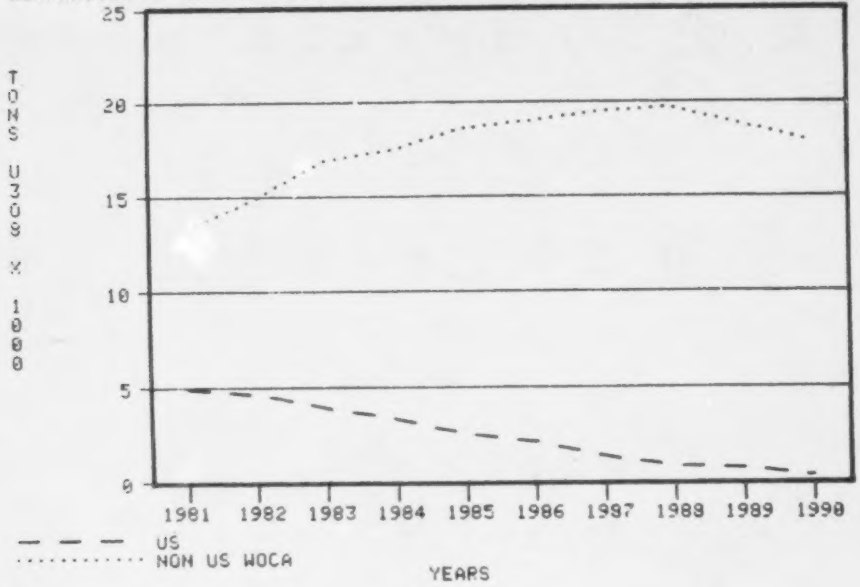


TABLE IV-26

TOTAL U.S. DEMAND FOR URANIUM AS REFLECTED BY EXISTING PURCHASE COMMITMENTS AND REPORTED UNFILLED REQUIREMENTS

(tons U_3O_8 x 1000)

Year	A U.S. Current Commitments to U.S. Producers	B U.S. Current Commitments to Foreign Producers	C Unfilled Requirements*	A + B + C Total "Demand"	1981 DOE Reactor Requirements
1981	18.0	1.9		19.9	14.4
1982	17.5	1.8		19.3	17.1
1983	15.9	1.8	0.9	18.6	18.9
1984	13.9	2.1	1.6	17.6	19.9
1985	11.7	2.1	4.2	18.0	21.9
1986	10.1	1.3	5.6	17.0	24.5
1987	8.7	1.2	8.4	18.3	24.2
1988	8.0	1.2	10.3	19.5	24.9
1989	7.8	1.2	9.5	18.5	24.9
1990	6.7	1.2	11.6	19.5	26.2

* NRI, June 1981.

TABLE IV-27

PROJECTED MAXIMUM IMPORT LEVELS IN DOMESTIC MARKET ASSUMING ALL DOMESTIC UNFILLED REQUIREMENTS ARE SUPPLIED BY FOREIGN URANIUM

(tons U_3O_8 x 1000)

Year	A Current U.S. Import Commitments	B Percent of Total "Demand"*	C Unfilled Requirements	A + C Total Maximum Imports	D Percent of Total "Demand"
1981	1.9	10		1.9	10
1982	1.8	9		1.8	9
1983	1.8	10	0.9	2.7	15
1984	2.1	12	1.6	3.7	21
1985	2.1	12	4.2	6.3	35
1986	1.3	8	5.6	6.9	41
1987	1.2	7	8.4	9.6	52
1988	1.2	6	10.3	11.5	59
1989	1.2	6	9.5	10.7	58
1990	1.2	6	11.6	12.8	66

* See Table IV-26.

> "Toward the end of the decade, more than half of the U.S. supply will come from non-U.S. sources. Canada, Australia, and Africa will be the dominant sources and Canada will be the most favored by the U.S. buyers."

Implications of the probable influx of foreign uranium to the domestic market are far-reaching. Figure IV-20 compares the uncommitted U.S. production capability (shown in Table IV-28) to unfilled requirements. Even if no further contracting of foreign uranium occurred, the remaining market available to domestic producers would significantly delay, but would still provide justification for, all projects currently under construction and planned.

The effects of a 20 percent foreign enrichment restriction are shown in Table IV-29 and Figure IV-21. The remaining unfilled requirements to be supplied by U.S. producers are significantly reduced to the point where even with additional delays in schedules, only those projects under construction and none of those planned, would be justified for the 1980's.

Obviously, if all unfilled requirements are covered by foreign producers, only those projects currently operating would remain in the picture. By 1990, projected U.S. production levels would drop to 7.1 thousand tons. (See Figure IV-7.)

As the comparisons indicate, further delays in new U.S. production are inevitable even if no additional foreign uranium is purchased. A future market will exist for U.S. producers provided a clean federal policy is established requiring the principle use of domestic uranium for power generating purposes. Implementation of this policy will by no means offer an instant cure to the ailing industry. However, it is important to realize that with production lag times up to 5 or 6 years after a deposit has been discovered, producers must have immediate assurances of a market several years hence in order to make the appropriate investments. The current degree of uncertainty regarding the

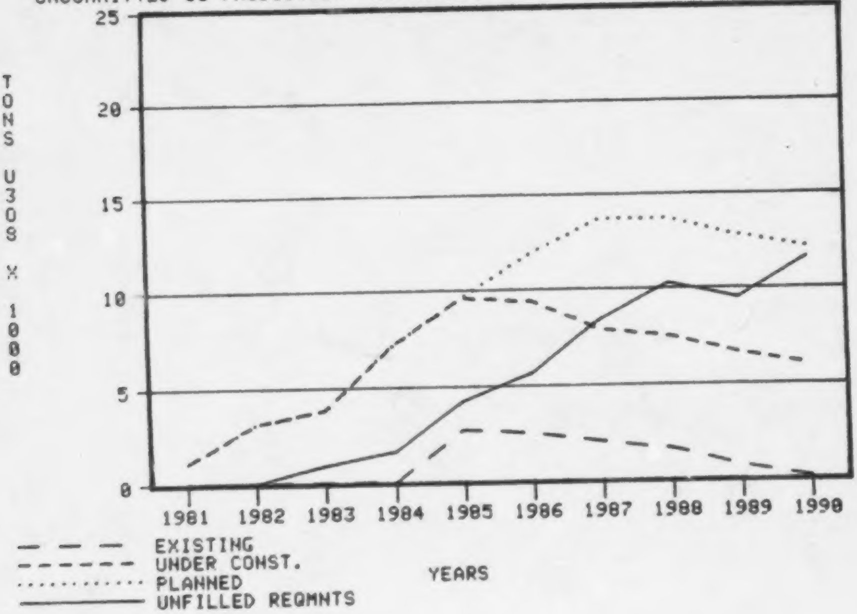


FIGURE IV-20

UNCOMMITTED US PRODUCTION (REQUIREMENTS REFLECT NO NEW IMPORTS)

TABLE IV-28

UNCOMMITTED U.S. PRODUCTION CAPABILITY (CUMULATIVE)
(tons U_3O_8 x 1000)

	A Existing	B Under Construction	C Planned
1981	(0.3)	1.1	1.1
1982	(0.2)	3.1	3.1
1983	(0.3)	3.8	3.8
1984	(1.8)	7.2	7.2
1985	2.7	9.6	9.6
1986	2.5	9.4	11.9
1987	2.0	7.9	13.7
1988	1.6	7.5	13.7
1989	0.7	6.6	12.8
1990	0.1	6.0	12.2

SOURCE: See Table IV-9.

45

TABLE IV-29

REMAINING UNFILLED REQUIREMENTS ASSUMING A 20 PERCENT LIMIT ON EXPORTS

(tons U_3O_8 x 1000)

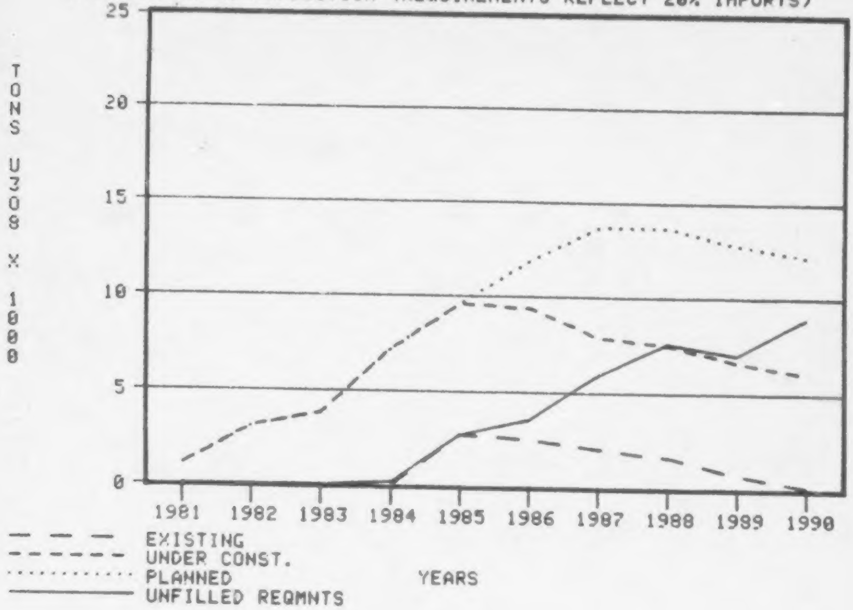
Year	A Imports at 20% of Total "Demand"*	B Current Import Commitments	C (A - B)	D Total Unfilled Requirements**	E (D - C) Remaining Unfilled Requirements
1981	4.0	1.9	2.1		
1982	3.9	1.8	2.1		
1983	3.7	1.8	1.9	0.9	
1984	3.5	2.1	1.4	1.6	0.2
1985	3.6	2.1	4.5	4.2	2.0
1986	3.4	1.3	2.1	5.6	3.5
1987	3.7	1.2	2.5	8.4	5.9
1988	3.9	1.2	2.7	10.3	7.6
1989	3.7	1.2	2.5	9.5	7.0
1990	3.9	1.2	2.7	11.6	8.9

* See Table IV-26, Column A+B+C.

** NRI, June 1981.

FIGURE IV-21

UNCOMMITTED US PRODUCTION (REQUIREMENTS REFLECT 20% IMPORTS)



domestic use of foreign uranium prevents U.S. producers from making any additional commitments to domestic uranium producers. This "wait and see" procurement policy may well turn into the situation where, even if U.S. utilities do decide to buy domestic uranium, it may not be available.

While prices for foreign uranium are currently very attractive, there may be nothing to prevent foreign governments from arbitrarily raising foreign uranium prices as the U.S. becomes more and more dependent on foreign uranium. The analogy to the oil situation is obvious. It is imperative to act now to prevent an unnecessary U.S. reliance upon foreign energy sources.

b. Additional Studies

Unlimited foreign uranium imports will significantly threaten the viability of the U.S. uranium industry. Rocky Mountain Energy strongly suggests that unrestricted uranium imports will cause:

- downward pressure on prices;
- instability of uranium prices;
- decreased demand for domestic production causing a decline in U.S. uranium production capabilities;
- decreased domestic exploration resulting in gradual depletion of existing domestic uranium reserves; and,
- delayed long-term uranium-contracting activity by domestic utilities as they become dependent on low, if not risky, uranium spot market prices.

Rocky Mountain Energy recently commissioned an assessment of the effects of varying levels of uranium imports on the domestic uranium industry. The study was conducted by the Colorado

Nuclear Corporation utilizing the "Eureka" uranium market computer model. Their study analyzed the effect of zero, 20 percent, 40 percent, and unrestricted uranium imports on the domestic uranium market. From this analysis, RME concluded:

- Permitting domestic utilities to enrich up to 20 percent of annual requirements from foreign sources would be appropriate. Levels lower than this would destabilize the uranium market. Higher import levels would be no more effective than natural market forces.

- A 20 percent enrichment limitation of foreign uranium would stabilize prices and ensure that an adequate level of U.S. uranium production is maintained to meet U.S. needs. This, of course, would be an extremely positive move toward maintaining a viable domestic uranium industry.

- The 20 percent limitation on enrichment of foreign uranium should be immediately promulgated by the Department of Energy. This would provide a planning base for domestic buyers and producers. It is clear that the psychological impact of the low-cost foreign uranium serves to discourage normal contracting by U.S. utilities as they "wait and see" if the market price will remain low.

- Whatever argument can be made for a 20 percent enrichment limitation becomes stronger as uranium demand for the rest of the Western world is lowered. Conversely, the argument becomes weaker should there be increased demand for uranium elsewhere.

(In this regard, it should be noted that the most probable uranium demand estimate is comparable to the low DOE-EIA estimate of August 1980. The low demand estimate is considerably below the DOE low estimate.)

(Colorado Nuclear Corporation (CNC) conducted this analysis for Rocky Mountain Energy; it should not be inferred that CNC advocates uranium import enrichment limitations.)

Another more recent study has been completed in a draft stage by the Energy Information Administration (EIA) of DOE. While results are still only preliminary, the EIA does not anticipate any significant changes from the following conclusions:

- Under the current government policy of import retriction removal, domestic production will fall "precipitously," particularly beyond 1990. Prices will remain low and inventories will continue to grow. Imports will reach a level of approximately 40 percent of total "demand" by 1990."
- Under a 20 percent import restriction, an initial drop in domestic production in the early 1980's is offset by a significant recovery, particularly beyond 1990. Price undergoes a sharp increase in 1985 and 1990 and then climbs steadily during the 1990's. Inventories are drawn down to below a year's forward coverage.

While the intricacies of market behavior can never be perfectly predicted, it is possible to observe and anticipate major trends. Clearly, whether a simple aggregate analysis or a sophisticated computer study is being used, the share of foreign uranium in the domestic market will increase at the expense of domestic production capability and ultimate energy independence.

D. Principal Problems

- Summary

In direct contrast to the positive outlook for nuclear power and the uranium industry in the early 1970's, the current uranium industry is significantly affected by: (1) declining uranium demand; (2) high production costs in relation to substantially low foreign uranium costs, and concurrently, the existing federal policy permitting the increased domestic use of foreign uranium; (3) anti-uranium efforts designed to totally stop uranium production and nuclear power development in the United States; and, (4) burdensome uranium regulations. Given these major problems, the current uranium industry has little incentive to grow or develop (i.e., to remain viable). It is imperative that the federal and state governments establish responsible uranium policies that will maintain a viable domestic uranium industry.

1. DECLINING URANIUM DEMAND

Forecasts for the growth of nuclear power have declined steadily since the early 1970's when the outlook was highly optimistic. Planning by U.S. producers has shifted from earlier aggressive expansion in assurance of a strong market, to more recent cut-backs and shutdowns as a result of significantly reduced demand.

2. INCREASING INVENTORIES

The buildup of utility-owned uranium inventories occurred as a result of the decline in nuclear growth and the change in DOE enrichment contracting policy which occurred in 1978. The recent drop in price is largely a result of utilities selling excessive inventories on the spot market. Inventory sales not only provide additional capital but also reduce holding costs for the financially ailing utilities. Present inventory levels represent almost four years of supply.

3. FOREIGN URANIUM

The extreme imbalance of existing uranium supply and demand in foreign countries, combined with the additional planned low-cost production, poses a substantial threat to the viability of the U.S. uranium industry.

The lack of economic incentives, in view of the possibility of a market flooded with low-cost foreign uranium, has already resulted in shutdowns and delays of domestic production centers. Utilities have begun to delay long-term contracting activities as they wait to see whether they can negotiate better contracts with foreign producers.

4. GOVERNMENT REGULATIONS

The uranium industry, like other segments of the nuclear industry, has in recent years been faced with an increasing number of federal and state regulatory controls relating to land use constraints, licensing and decommissioning mills, and minimizing the environmental impact of mill tailings. The bases for these regulatory controls have not always been clear. For example, the GEIS on uranium mining and milling, recently issued by the NRC, consistently overestimates environmental impacts and underestimates what it will cost the industry to conform to mitigating regulatory controls. Further, the uranium industry is now faced with the threat of state moratoria which, in some instances, are totally unrelated to uranium mining and milling, but instead are tied to the disposition of high-level radioactive wastes produced during reactor operations.

Compliance with the new NRC uranium milling and tailings regulations will impose substantial costs on the uranium industry without commensurate benefits to public health and safety, or to the environment. For example, the regulations will require uranium mills to limit radon emissions to an unnecessarily low 2 pico-curies per square meter per second ($2pCi/m^2/sec$). In addition, the NRC will require the covering of tailings piles with three meters of earth even if this is unnecessary to meet the $2pCi/m^2/sec$ requirement. Notwithstanding substantial industry comment opposing these specific provisions, the NRC promulgated them without adequate consideration of the substantial costs involved in meeting these questionable standards.

The new NRC regulations will also require that in semi-arid regions, rock cover will be used when a full vegetative cover is unlikely to be self-sustaining to reduce wind and water erosion. The rock cover, according to the regulations, must be cobble size or greater and individual rock fragments must be free from cracks, seams, and other defects. Clearly, the intent of the NRC to establish long-term protection for the environment cannot be faulted, yet the stringent nature of the regulations will add substantial costs without properly weighing the slight benefit to the surrounding areas. Additional NRC regulations severely affecting uranium operations include the implementation of EPA's radiation standards set forth at 40 CFR Part 190 pertaining to uranium mills. Given the arbitrary nature of this particular standard, it is not practicable at reasonable cost; a practicable standard should be established via a new rulemaking proceeding.

In January 1977, the Environmental Protection Agency promulgated radiation protection standards for the general public. EPA sets a 25 millirem whole body dose limit to any member of the public from planned releases from any activity in the uranium fuel cycle. This standard became effective for uranium mills December 1, 1980.

The 25 millirem whole body dose limit was promulgated in 1977 to purportedly change the primary focus of radiological protection from limitations on dose to the maximally exposed individual, to limitations on dose to the total population. Since EPA set this standard in 1977, however, developments have occurred that render the regulation unreasonably burdensome on the uranium milling industry. For example, EPA's new model mill differs from the model used to develop the existing standards. In addition, new dose conversion factors, new health effect conversion factors, and new cost data for source term controls, have been established which point to the fact that the 25 millirem standard is no longer practicable nor cost-effective. It should also be noted that the 25 millirem standard as applied to uranium mills should be reconsidered due to serious inadequacies in the administrative record which fail to adequately explain the basis of the 25 millirem standard.

Rocky Mountain Energy strongly supports federal efforts to protect the public health and safety and encourages the federal government to investigate all reasonable methods of protecting the public health and safety from unreasonably high levels of radiation. However, RME considers the 25 millirem standard to be unreasonably stringent and urges that it be revised.

5. HIGH U.S. PRODUCTION COST

The majority of the known U.S. uranium reserves exist in relatively high forward cost categories which are uneconomic to mine in the currently depressed market. These high-cost reserves are even more dramatically uneconomic in relation to the extremely low-cost foreign reserves.

Unusually low market prices have significantly reduced the necessary margins of profit for existing operations and drastically altered anticipated rates of return on planned operations. The recent drop in price has not only discouraged plans for future growth but also threatened the probability of maintaining existing operations.

6. ANTI-URANIUM EFFORTS

A major problem affecting responsible uranium development is public sentiment concerning uranium operations and development of nuclear power. The uranium industry has recently come under harsh public criticism and restrictive government actions limiting, if not totally precluding, uranium operations in a given state or jurisdiction.

The recent agitation of public opinion against uranium exploration, mining, and milling, must be considered in the context of recent surveys indicating support for nuclear power and uranium mining. A plurality of the public supports uranium mining and nuclear power. A July 1980, Cambridge Report, survey indicates public opinion supported nuclear power by 46 percent in favor, to 41 percent opposed. In addition, a Harris survey indicated that 77 percent of those polled favored continued use of nuclear power even though it was recognized that risks are present in the use of this form of electrical power generation.

Recently considered state initiatives in South Dakota and Montana specifically addressed the uranium industry. The initiatives were drafted to prevent further uranium operations in those states. South Dakota voters rejected the uranium moratorium, yet Montana voters passed the anti-uranium initiative by a slim margin. In addition, Governor William Milliken established a one-year moratorium on uranium exploration in Michigan until the issue of health affects of uranium exploration could be studied by the state government. Proponents of anti-uranium initiatives and legislation argue that nuclear power and uranium are unsafe and, therefore, uranium operations should be terminated. The uranium industry has undertaken a costly public affairs effort to address public concerns, improve uranium operations, and hopefully, counteract expected anti-nuclear and anti-uranium efforts.

While the actions of the few opposing nuclear power and uranium mining frequently serve to frustrate responsible uranium operations, it is clear that the majority of Americans favor the continued use of nuclear power and responsible development of uranium to meet U.S. energy needs.

* * *

KERR-McGEE NUCLEAR CORPORATION

U.S. GOVERNMENT ENRICHMENT OPERATIONS

THE SPLIT TAILS CONCEPT

August 1981

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SECTION 1

INTRODUCTION

The purpose of this report is to examine and document the "split tails" enrichment concept as utilized by the U.S. Government during fiscal years 1972 through 1978, and from this examination to investigate possible changes in tails assays that could aid in stabilizing the market for uranium in the 1980's. Since the use of split tails affected both the uranium and enrichment markets, an understanding of the interrelationship between these two markets is essential and is recognized in this report.

Between the passage of the Private Ownership of Special Nuclear Materials Act in 1964 and the implementation of split tails operations of the enrichment facilities, there were substantial dialogues between the Atomic Energy Commission (AEC) and the Joint Committee on Atomic Energy (JCAE). Split tails operations was one of several AEC uranium policies that were discussed. A history of the split tails concept is presented in Section 2, including the stated objectives of the program.

The remaining two sections of the report look at the split tails concept and its affects on the uranium industry, the enrichment industry and U.S. Government enrichment operations. The "sale" of AEC-owned natural uranium is summarized to document the overall magnitude of the previous split tails operation. An accounting of both inventory use and sale is presented insomuch as it illustrates previous policy changes and establishes the current inventory of supplemental feed contained in the preproduced stockpile.

Finally, possible applications of tails changes to stabilize the uranium market in the 1980's are investigated. The following tails scenarios are examined:

1. split tails where the operating tails is 0.25 w/o and the transactional tails is 0.20 w/o.

2. "reverse" split tails where the operating tails is 0.20 w/o and the transactional tails is 0.25 w/o, and
3. a unified tails assay increase where both the operating and transactional tails are raised to 0.25 w/o.

The potential costs and benefits of these three approaches are introduced as a basis for assesssing the relative merits of each. The cases are then compared, and the specific impacts on the uranium market are presented.

SECTION 2
BACKGROUND

2.1 History of the Split Tails Concept

In August 1964, the U.S. Congress passed the "Private Ownership of Special Nuclear Materials Act". Among other things, two principal purposes of the Act were:

- termination of mandatory Government ownership of Special Nuclear Materials; and
- authorization for providing uranium enrichment services.

Nuclear materials were no longer considered in short supply, and effective controls over special nuclear material (SNM) were not considered dependent on mandatory Government ownership. Thus, the stage was set for development of the commercial nuclear fuel cycle as it exists today. Only the provision of enrichment services was to remain a function of the Atomic Energy Commission (AEC).

Four basic reasons were given for the enactment of the above legislation.(1) These reasons were:

1. Need for long range planning. The ability of the utilities and nuclear industry to plan for nuclear fuel supplies on a long-term basis under normal economic conditions was considered essential.
2. Government inventories of nuclear fuel. During the 1950's and 1960's, Government purchases of natural uranium greatly exceeded military requirements. Under Government ownership of SNM, some level of uranium stockpiles was considered necessary to assure the supply of fuel to commercial reactors. The private ownership legislation was intended to eliminate the necessity for a major buildup of Government inventories of nuclear fuel for commercial reactors. In 1963 testimony, the AEC estimated that continued mandatory Government ownership would result in inventories by 1975 valued in excess of $1 billion.

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(1) "Private Ownership of Special Nuclear Materials Act", United States Code, Congressional and Administrative News. 88th Congress-2nd Session. (New York: West Publishing Co.), pp. 3105-3123.

3. Future of the domestic uranium industry. Until the passage of the Private Ownership Act, the domestic uranium mining and milling industry was completely dependent on purchases by the Government. Passage of the Act permitted the industry to develop without future reliance on the U.S. Government for its market. Thus, with the commercial nuclear industry as its primary customer, the "maintenance of a viable uranium mining and milling industry is an essential part of a sound nuclear industry...."

4. Effect on the foreign civilian nuclear power program. The availability of enrichment services to foreign customers was expected to provide further assurances of a long-term supply of enriched uranium to other nations.

The private ownership act identified at least two of the major forces contributing to the introduction of the "split tails" policy.

- Excessive inventories of nuclear fuel are a burden to the taxpayers and should be avoided; and
- The Government must insure the viability of the domestic uranium industry.

Hearings before the Joint Committee on Atomic Energy (JCAE) during August 1966 further explored the expected inevitable disposition of the AEC's natural uranium inventory.(2) AEC testified that they could not "determine ... just what indexes should be used to determine the future viability of the domestic uranium market ...." However, AEC reaffirmed that disposition of surplus inventories would occur only after the uranium industry attained viability, and even then "based on an appropriate sharing of market growth beyond the point of viability".

On September 6, 1968, AEC issued a revised statement on its uranium supply policies. This statement is included in the report as Exhibit A since it represents the initial step in Government policy for uranium supply prior to the consideration of split tails operation. In 1967, AEC projected installed nuclear capacity in 1980 in the range of 120-170 GWe. The ability of the commercial uranium industry to provide the necessary natural uranium feed was in question even though rapid expansion in the level of exploration for additional reserves was underway. The substantial demand and rising prices resulted in increased interest by consumers in the possible purchase of enriched uranium from the U.S. Government stockpile. AEC policies on the supply of uranium as they existed at the time are summarized below.

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(2) Hearings before the Joint Committee on Atomic Energy. Uranium Enrichment Services Criteria. August 1966. pp. 14-105.

- AEC price of $8 per pound of U_3O_8 for Government sale would continue at least through June 30, 1973.
- Enriched uranium sales would be limited to single (spot) sales with some exceptions.
- Disposal of Government feed stocks would not be undertaken until it could be done in a manner which would not adversely affect the viability of the uranium industry.
- Enriched uranium on lease could be converted to private ownership through "in situ" toll enriching beginning in 1971.
- The transition to private ownership of all material held or procured by licensees for power reactor use would be accomplished on the schedule already applicable under the Atomic Energy Act of 1954, as amended.
- In order to assure maintenance of a viable domestic uranium industry, AEC would agree not to enrich foreign uranium for use in domestic facilities. This policy would be reviewed from time to time to determine the need to continue this restriction.
- In considering requests for spot purchases of Government-owned uranium, AEC required evidence that the applicant was unable to purchase natural uranium from private domestic sources.

The issue of viability of the uranium industry was never properly defined. A quantitative description of viability would not be offered by AEC. To the author of this report, the concept of viability of the uranium industry is similar to the concept of enlightenment in Zen. One does not really know what it is until one actually experiences it. However, in the 1968 press release, the factors AEC felt should be considered in characterizing a-viable uranium industry were set forth. They are:

- size of the domestic uranium market
- price of uranium at the time the restrictions are removed
- size of the domestic ore reserves
- rate of development of new reserves
- probable penetration of the domestic market by foreign imports
- size of the export market

In a 1970 Report to the AEC General Manager by the Assistant General Manager for Plans, the interrelationship between the proposed AEC uranium disposal policy and the operation of the gaseous diffusion plants (GDP) was compared. Studies at that time indicated the optimal tails assay (determined by equating the marginal costs of feed and separative work) was gradually increasing. An increase in the then current GDP operating tails assay was thus considered appropriate for the following reasons.

- increases in the cost of power to the GDP.
- interrelationship between AEC policy for surplus natural uranium disposal and the GDP operating tails assay.
- considerations of risk in planning for future GDP operations (a higher near-term operating tails assay provides more flexibility to accommodate deferral of additional capacity or unanticipated increases in demand).

Prior to this time, a policy for direct disposal of AEC surplus natural uranium stocks had been submitted to OMB on December 22, 1969. The procedure, known as the "1/3-1/5 disposal rule", called for AEC sales of U_3O_8 beginning in FY 1975. The use of a higher tails assay in this procedure would allow disposal of excess natural uranium at an earlier date than possible with the then current 0.20 w/o* assay due to increased uranium demand.

The flexibilities inherent in the submission to OMB were explored in the above 1970 Report to the General Manager. Two methods of sale were considered jointly with the objective of disposing of excess natural uranium as early as possible. They were:

- sale of U_3O_8 beginning with 500 metric tons of uranium (MTU) in FY 1975 and increasing by 500 MTU per year.
- operating at a higher tails assay and supplementing customer feed with AEC-owned material.

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* weight percent of U-235

The combination of these two approaches left an industry level of sales termed the "Viability Schedule". This schedule was intended as illustrative and for planning purposes. AEC would maintain the flexibility to modify actual sales based upon changes in market projections, market viability and other economic factors. Thus, the concept of sales of supplemental feed through split tails operation of the GDP was first introduced in this 1970 report, although it would be approximately two years before it was presented in Congressional hearings.

During hearings before the Joint Committee on Atomic Energy (JCAE) in March and May 1971, the AEC was questioned extensively on a decision to raise the operating tails assay of the GDP complex from 0.2 w/o to 0.3 w/o during FY 1972 and FY 1973. The transaction tails assay would remain at 0.2 w/o. Enriched product delivered to the customer during this two year period would come from AEC's preproduced stockpile (produced at a tails assay of 0.2 w/o). Therefore, there were no supplemental sales of U_3O_8 planned for this two year period. The enriched uranium produced during this period was simply to be stockpiled.

The reason given for increasing the tails assay was that the "optimum tails assay" was increasing due to increasing power costs. Some members of the JCAE suspected that the increase was at least in part due to a desire on the part of the Administration to delay the Cascade Improvement Program (CIP) and the Cascade Uprating Program (CUP), two long-term programs for increasing the capacity of the existing gaseous diffusion plants. However, the AEC representatives maintained that the operating tails assay would be increased regardless of the schedule for CIP/CUP. It was speculated by AEC that at the end of the two year period the operating tails assay would be reduced to about 0.25 w/o with the transaction tails assay also increasing from 0.2 w/o to 0.25 w/o. This transactional tails increase would require customers to provide additional feed. Hence, up to this time there was no indication in the Congressional hearings that the AEC would introduce supplemental sales or loan (trading) of AEC-owned U_3O_8 contained in the preproduced stockpile. Excerpts from these Hearings are included as Exhibit B.

Based on consultations with OMB, the AEC announced on October 13, 1971, a proposed plan and schedule for the sale of the natural uranium inventories (Exhibit C). The announcement solicited comments from the industry on the proposed disposal plan. The plan, which was somewhat different from the "1/3-1/5 disposal rule" originally submitted to OMB, contemplated deliveries of AEC uranium to the market beginning in 1974, when the plants would be operating at unified 0.25 w/o tails. It formulated limitations on quantities which would be delivered in any year, and established a ceiling of 7500 tons U_3O_8 per year as an upper limit for disposal at any time during the program. The plan proposed lower deliveries during 1974 and 1975 than would otherwise have been provided for by the formula in view of the soft market situation prevailing during that period.

The main thrust of the comments, received principally from the uranium producing industry, were:

- Disposal of the Government's natural uranium stockpile should be deferred (possibly indefinitely to insure against future shortages).
- Direct Government sales of uranium might discourage private investment needed to expand uranium supply.

Between 1970 and early 1972, AEC staff considered supplying supplemental feed under split tails operation as an alternative to the direct sale of the natural uranium inventory. Under this arrangement, enrichment services customers would supply insufficient feed to produce their enriched uranium requirements at the higher operating tails assay. They would, however, pay for a greater amount of SWU than actually used in producing the enriched product. AEC would supply, from its surplus inventory, the additional feed necessary to produce the customer's product and a portion of the customer's cash payment would constitute payment to AEC for the additional feed used.

Testimony before the JCAE during the FY 1973 Authorization Hearings held on March 7-8, 1972 by Dr. James R. Schlesinger, Chairman, USAEC, provided formal recognition of the split tails alternative for disposal of excess inventories (Exhibit D). Recognizing that industry response to the sale of the 50,000 tons U_3O_8 had been overwhelmingly negative for a variety of reasons, but further recognizing the large investment in that stockpile could not be frozen indefinitely, the concept of split tails operation was advanced as a mechanism which, among other important considerations, would reduce the inventory of surplus feed in a manner which would avoid direct competition by the Government in the private uranium market.

It is important to note that this testimony represents a philosophical departure from operating plans previously considered. Prior to this testimony, future operations were expected to be at a unified tails assay whereby the plant operating tails and transaction tails for enrichment service customers would have the same value. Dr. Schlesinger indicated in his testimony that split tails operation would continue beyond the initially planned two year period.

Chronologically, the actual history of split tails operation from 1973 to the present is not documented to any significant extent. In the transitional steps where part of AEC became the Energy Research and Development Administration (ERDA) and the absorption of ERDA into the new Department of Energy (DOE)--together with the legislative elimination of the Joint Committee on Atomic Energy (JCAE)--testimony and publication of detailed operating aspects of the uranium enrichment plants became considerably less significant.

The operating tails assay was raised to 0.30 w/o at the beginning of FY 1972 and remained at that value through FY 1975. In FY 1976, the operating tails assay was reduced to 0.25 w/o. A discussion of the operational change can be found in a paper by Mr. Sullivan presented during the Uranium Enrichment Conference held in Oak Ridge, Tennessee on November 11, 1975 (Exhibit E). The decision to lower this assay was apparently based principally on an evaluation of feed availability and usage over the next several years.

At the same time, ERDA began the recycle of the 0.30 w/o tails material which resulted from the previous operating mode. Between FY 1976 and FY 1978, 2326 MTSWU* were used to produce 3548 MTU of equivalent normal feed which was subsequently disposed of as supplemental feed during the period FY 1978 through FY 1979.

Operating tails remained at 0.25 w/o through September 30, 1978, the end of FY 1978. However, on October 1, 1978 operating and transaction tails became unified at 0.20 w/o, and have remained unchanged from that time. This change in operations was reviewed by Mr. Voigt in October 1978 (Exhibit F). Again, the decision to decrease the operating tails assay was a purely operational one, based upon reviews of decreasing projections of nuclear power growth, DOE's enrichment plant construction programs, and DOE's inventories of natural and enriched inventories. Voigt indicated an operating tails assay of 0.20 w/o could probably be continued until the late 1980's and still maintain reasonable enriched uranium inventory levels. This viewpoint was later re-iterated during testimony before the House Committee for Science and Technology by Mr. George McIsaac in February 1979.

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*metric tons of separative work units

2.2 Considerations Surrounding Split Tails Operation

The previous subsection traced the history of the split tails concept in detail. As pointed out in the Section 1, this concept was one part of a larger AEC uranium supply policy. Early policies by the AEC were clearly keyed to turning over to private industry as many of the fuel cycle activities as feasible. Among these, a major objective was to maintain a viable domestic uranium industry. In addition to refraining from direct competition with uranium producers, the embargo against the enrichment of foreign origin uranium for use in domestic reactors was maintained until 1977 when gradual relaxation of the restriction began.

A major objective of the split tails concept was to reduce the large AEC-owned natural uranium stockpile which was an increasing burden to the American taxpayer. In the process, the Government had spent two decades building a domestic uranium industry and did not want to do anything to jeopardize its existence.

A second, less-publicized objective can be found in a statement by Mr. George F. Quinn before the JCAE in July 1973. Consistent with the goal of the Executive Branch to transfer commercial enrichment to the private sector, the establishment of a higher tails assay served to defer the date when new capacity would be acquired, "thus providing ... greater time to permit private plans to be made and decision reached." However, privatization of the enrichment industry was never accomplished.

In summary, the split tails mode of operation was the means to an end for AEC to accomplish the above objectives. However, it should be kept in mind that other policies such as the embargo on the enrichment of foreign uranium and enrichment contracting policy were equally important in the overall strategy and cannot be ignored in any comprehensive analysis.

SECTION 3

EFFECTS OF SPLIT TAILS OPERATION DURING FY 1972 THROUGH FY 1978

3.1 Explanation of Split Tails Concept

The process of enrichment involves the upgrading of the fissile content (U-235) of uranium as it is found in nature to a level which will sustain a chain reaction in certain types of nuclear reactors. The ratio of the weight of U-235 to the total weight of the element is called the assay of U-235. Uranium found in nature usually has an assay of 0.711 w/o U-235. This normal or natural uranium is the feed for the enrichment process. For operation of light water reactors, the U-235 content needs to be increased to a level of 2-4 w/o which is referred to as the product assay. The process of enrichment results in some loss of the U-235 content in the waste stream, which usually has an assay in the range of 0.2-0.3 w/o and is called the tails.*

The three streams--the feed, product, and tails--are interrelated. Holding the amount of product constant, increasing the tails assay increases the amount of uranium feed required because less enrichment (separative work) is utilized. Thus, by specifying the tails assay, the enricher can influence the amount of natural uranium feed needed by its customers to fuel their reactors. An additional distinction needs to be made in reference to the tails assay. Due to the contract instruments, the tails assay which determines the amount of uranium a utility has to deliver to the enrichment plant does not have to be the tails assay at which the plant operates. The former tails assay is referred to as the transactional tails assay and the latter as the operational tails assay. The phenomenon of having a transactional tails assay different from the operational tails assay is known as split tails.

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* The fissile content of the uranium is only lost in the sense that it does not go into the product stream. However, the tails themselves can be recycled if the assay of the tails material is greater than the operating tails assay of the plants.

An example of split tails concept would be where the enricher is operating his plant at a tails assay of 0.25 w/o and the customer is providing feed based upon a transactional tails assay of 0.20 w/o. In this case, since the utility is delivering feed on the basis of a 0.20 w/o tails but the plant is operating at a 0.25 w/o tails, the enricher must provide the additional feed because of the inverse feed/tails assay relationship discussed above. Alternatively, if the plant was operating at a 0.20 w/o tails assay but the enrichment service was transacted at 0.25 w/o, the enricher would be building up a stockpile of uranium due to excess feed deliveries by the customer. Thus, the enricher is either building up or drawing down inventory if the transactional tails assay is different from the operating tails assay. In all cases, however, an increase in either the transactional or the operating tails assay increases the demand for natural uranium.

The specific effect on the enricher's inventory of uranium due to operating in a split tails mode is provided in the following Table 3.1.1 for a hypothetical Pressurized Water Reactor needing approximately 27,000 kgU of enriched product per reload at a 3.0 w/o product assay.

TABLE 3.1.1

EFFECT OF SPLIT TAILS ON REQUIREMENTS FOR
1000 MWe PRESSURIZED WATER REACTOR
(Reload: 27000 kgU Enriched Product at 3.0 w/o)

	Input Quantities		Changes in Requirements (Base 0.20% Tails)	
Tails Assay (w/o)	Separative Work Units	Uranium Feed (lbs. U_3O_8)	Decrease in SWU (%)	Increase in Feed (%)
0.20	116,300	386,600	N/A	N/A
0.25	102,900	420,900	13,400 (11.5)	34,300 (8.9
0.30	92,500	463,500	23,800 (20.5)	76,900 (19.9

At a transactional tails assay of 0.20 w/o, this utility would be required to deliver approximately 386,600 pounds of U_3O_8 to the enrichment plant.* Alternatively, at a tails assay of 0.25 w/o, the utility would be required to supply approximately 420,900 pounds U_3O_8 for this reactor, or 34,300 pounds more than at a 0.20 w/o assay. In this example, if the transactional tails assay is 0.20 w/o and the operating tails assay is 0.25 w/o, the enricher must supply the additional 34,300 pounds of U_3O_8 to make up for the difference in feed requirements at the two assays. If this practice is followed for every utility delivering uranium to the enricher, the enricher would be supplying 8.9% of the total feed requirements for its customers. The increase in uranium feed requirements resulting from increasing the tails assay from 0.20 w/o to 0.30 w/o for this example is 19.9%.

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*It is also instructive in considering the split tails option to examine the effective price that the customer is "paying" for the supplemental feed. For this calculation, the following prices will be used:

UF_6 Conversion	\$ 1.15/lb U	(\$2.53/kg U)
Separative Work	\$119.00/SWU	(Requirements price)

The effective price that the customer pays for the supplemental feed is given below assuming a 3.0 w/o product assay.

SWU/kg product required,	0.25 w/o	3.811
SWU/kg product required,	0.20 w/o	4.306
Difference		0.495
Feed/kg product required,	0.25 w/o	5.965
Feed/kg product required,	0.20 w/o	5.479
Difference		0.486

$$\text{Effective price} = \text{Requirements price} \times \frac{\text{decrease in SWU}}{\text{increase in feed}}$$

$$= \$119.00 \times \frac{0.495}{0.486} = \$121.20/\text{kg U feed}$$

$$= \$\ 45.64/\text{lb } U_3O_8$$

Thus, the customer would effectively pay \$45.64/lb U_3O_8 for the supplemental feed. The August 1981 Nuexco spot value is \$23.50/lb U_3O_8.

3.2 Operating Mode

The toll enriching program began on January 1, 1969. Between this date and the beginning of FY 1972, the enrichment complex was operated at 0.20 w/o tails assay which was identical to the transactional tails assay. The situation where both operating and transactional tails assays are established at the same level is called unified tails. In July 1971, the split tails program was instituted.

The split tails operations were conducted over the period FY 1972 through FY 1978. A summary of the transaction and operating tails assays since the inception of the toll enrichment program is provided below.

Date		Tails Assay, w/o	
From	To	Operating	Transactional
1/1/69	6/30/71	0.20	0.20
7/1/71	6/30/75	0.30	0.20
7/1/75	9/30/78	0.25	0.20
10/1/78	present	0.20	0.20

As noted in Section 2, the duration of operations at a tails assay of 0.30w/o was originally planned for two years, subject to change towards the end of the period. In reality, that tails assay was maintained for four years, and a 0.25 w/o assay was used for three additional years.

The percent of U-235 that ends up in the product stream (for 3% enriched product) decreases from 77% to 64% as the tails assay increases from 0.20 w/o to 0.30 w/o. This fact alone, however, does not necessarily indicate under-utilization of resources. Only when the operating tails assay is above the optimum tails assay does true under-utilization occur. In the selection of a higher tails assay of 0.30 w/o by AEC, it was recognized that the optimum assay was slightly lower. However, this selection preserved the option to recycle the resulting tails material and strip the U-235 assay further at a small economic cost.

Beginning in FY 1976 when the operating tails assay was lowered to 0.25 w/o, the tails material accumulated from the previous 0.30 w/o operation was recycled. Between FY 1976 and FY 1978, 2326 MTSWU was used to create 3548 MTU of normal uranium equivalent.(3) This recycled material was subsequently disposed of in FY 1978 and FY 1979. The use of this material as supplemental feed will be further discussed in the following section.

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(3) U.S. Department of Energy, Uranium Enrichment Annual Report - FY 1979, p. 30.

3.3 Sales of Supplemental Feed

In the late 1960's, AEC was examining methods of disposing of surplus stockpiles of natural uranium. When the split tails program was implemented, however, sale of supplemental feed to the toll enriching customers was not indicated. For the initial two year period of split tails operation (FY 1972 and FY 1973), customer deliveries were to be met from enriched AEC stockpiles previously produced at 0.20 w/o tails assay. The product resulting from operation at 0.30 w/o tails assay was to be added to the preproduced enriched stockpile.

Following the rejection of a plan to sell AEC-owned surplus natural uranium directly into the market, the decision was made to gradually dispose of the surplus through the extended use of split tails operation. The basic concept was for the customer to deliver feed and pay for separative work on the basis of a 0.20 w/o transaction tails assay. Since the Government would actually be furnishing less separative work (depending on whether operation was at 0.30 w/o or 0.25 w/o), the difference in revenues between the two cases would be applied as compensation for the AEC-owned supplemental feed used in the process. In practice, the price of the additional feed was passed on to all customers who took enriched product deliveries in a particular year.

NRI has extracted the data on supplemental feed sales from the Uranium Enrichment Services Activity Financial Reports for the years FY 1972 through FY 1980. These data are presented in Table 3.3.1.

When supplemental feed sales were first selected as the mechanism for disposing of excess inventories, the expected operating tails assay beginning in FY 1974 was 0.275 w/o. This assay was selected to provide AEC reimbursement for the feed at current market value. Subsequent review resulted in the continuation of a 0.30 w/o operating tails assay. In its financial treatment, AEC allocated revenues from separative work sales for the supplemental feed furnished, based upon its assessment of an average value of feed delivered for that year.

TABLE 3.3.1
USAGE AND SALE OF SUPPLEMENTAL FEED

Fiscal Year	Supplemental Feed, MTU Processed Annual	Supplemental Feed, MTU Processed Cumulative	Supplemental Feed, MTU Shipped Annual	Supplemental Feed, MTU Shipped Cumulative	Revenue from Supplemental Feed($000)
1972	2706	2706	0	0	0
1973	3506	6212	0	0	0
1974	3301	9513	4281	4281	93,532
1975	3619	13132	2208	6489	52,119
1976	1908	15040	2133	8622	72,253
1977	2599	17639	1562	10184	71,848
1978	131	17770	1857(1)	12041	0
1979	0	17770	891(1)	12932	0
1980	0	17770	385	13317	NA(2)

(1) recycled 0.30 w/o tails assay material.

(2) appropriate level of details not provided in financial report.

As of the beginning of FY 1981, 4428 MTU as UF_6 of supplemental feed was contained in the DOE-owned preproduction stockpile. Table 3.3.2 presents a quick summary of the total supplemental feed balance. The data from the financial reports are accurate to within 0.2%. The remaining supplemental feed contained in the preproduced inventory can be expected to be sold over the next few years as DOE supplies product from its stockpiles.

TABLE 3.3.2

SUMMARY OF SUPPLEMENTAL FEED SALES

	Supplemental Feed, MTU	
Beginning Inventory, FY 1972	0	
Deliveries, FY 1972-FY 1980	13,317	
Ending Inventory, FY 1980	4,428	
TOTAL Supplemental Feed	17,745	vs. 17,770(1)

(1) Total Supplemental Feed as reported in the Financial Statements.

SECTION 4

POSSIBLE APPLICATION OF TAILS CHANGES TO STABILIZE THE URANIUM MARKET

In Section 3 we saw the past effects of split tails operation. Given the current depressed state of the uranium market, its gloomy future outlook, and the Government's mandated responsibility for assuring the viability of the domestic producing industry, it is instructive to investigate the role that tails changes could have in stabilizing the uranium market.

In this section we will evaluate the pros and cons of three different operating/transactional tails assay options that could aid in stabilizing the uranium market. These options are shown in Table 4.1 below.

TABLE 4.1

POSSIBLE OPERATING MODES AT HIGHER TAILS ASSAYS

	Tails Assay, w/o	
Option	Operating	Transactional
Split Tails	0.25	0.20
Reverse Split Tails	0.20	0.25
Higher Unified Tails	0.25	0.25

These options obviously do not exhaust the set of possible tails variations but they have been selected for illustrative purposes conditioned on the constraints of current enrichment contracts. Under the Adjustable Fixed-Commitment (AFC) contract, the customer has the option to terminate if the Government raises the transactional tails assay above 0.25 w/o. Thus, it would certainly not be in DOE's best interest to assume a higher assay. Moreover, because of the relationship between the uranium and enrichment markets, it is necessary to look at both these markets when evaluating the different options.

4.1 Split Tails

The first option to be investigated is the split tails mode as used in the 1970's, with the operating tails assay at 0.25 w/o and the transactional tails at 0.20 w/o. The two primary affects of this mode of operation are to:

- increase feed requirements by a maximum of 8.9%, and
- decrease SWU requirements by a maximum of 11.5%.

Within each of these two primary affects are a number of secondary, and even tertiary effects, which need to be documented and examined.

The extent to which uranium feed requirements would be increased depends on the weighted average tails assay selected by customers with AFC contracts because of the Variable Tails Assay Option (VTAO). If all of these customers chose to select the 0.20 w/o tails, the effect on feed requirements would be to increase them by 8.9%, as was shown in Table 3.1.1. However, the increase in feed requirements would most likely be somewhat less than this amount. Under this option, it would be necessary for the Government to supplement customer feed deliveries with feed of its own. Thus, the resulting impact on the uranium market would depend on the Government's inventory policy.

If the Government chose to maintain a constant inventory level, it would need to go into the market to obtain the supplemental feed. Of course, if such a program were enacted with the aim of protecting the viability of the domestic producing industry, the Government would go only to domestic producers to purchase this supplemental feed.* Thus, the Government would have control over the impact that this approach would have on the domestic producing industry, depending on the inventory level the Government wants to maintain. Additionally, this approach could allow the Government to fine tune its purchases to provide a steady increase in demand and a stable price situation.

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* This assumes that the Government has the ability to discriminate against buyers, because U.S. utilities have large quantities of excess uranium inventories that they could sell and are active participants in the current spot market. This assumption will be maintained throughout the remainder of this Section. Alternatively, the U.S. Government might decide to buy only domestic uranium, or it could entertain all offers to sell. Relaxation of the assumption would mean that U.S. producers would likely get a smaller share of the Government purchases.

There are potentially two main drawbacks with such direct Government purchases from the industry. The first is that the U.S. taxpayers would be subsidizing the U.S. uranium industry. If the full costs of these purchases were passed on to the enrichment customers (primarily utilities), the ratepayers or stockholders of the utilities, or both, would be subsidizing this activity. In either case, there would be an income transfer from one group (or groups) to another, a transfer which might be considered objectionable. However, this income transfer might not be detrimental to society if the maintenance of a viable U.S. uranium producing industry provides a benefit in the long-run for reasons such as supply assurance. Thus, it is not clear whether such a program would be objectionable, considering the possible long-run benefits as well as the short-run redistribution of income.

The second drawback of this approach is that the Government, in making such direct purchases, might be setting the price of uranium.* Because there are so few indicators of uranium prices, any Government purchase price might be easily accepted. It can be argued that having the Government setting the uranium price may or may not be a desirable goal, but those arguments are not relevant here. The point is that the Government would be seeking to stabilize the uranium market through purchases necessary to support the split tails program, and not by setting the price of uranium. If it turns out that the Government is setting the price of uranium _de facto_, and if this possibility was not recognized when the purchases began, then the resulting effect on the uranium market might be quite different than originally envisioned.

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* This is not to say that the Government should not set a price at which _it_ will buy feed, but that others might adopt this price.

Adoption of this split tails (0.25 w/o operating tails assay, 0.20 w/o transactional tails assay) approach by the Government would also have an effect on the enrichment market and the Government's operation of the enrichment plants. Less SWU would be produced, with the following effects:

- The enrichment plants would be even less utilized than under current operations;
- following from the first effect, the need for additional capacity (GCEP) would be increasingly lessened; and
- also following from the first effect, the price of separative work increases because the Government's fixed costs are spread over fewer SWU sales.*

The higher price of SWU would in turn have two effects. First, for those enrichment customers with AFC contracts, the higher prices would theoretically cause them to select a higher transactional tails assay, thus increasing the demand for uranium, everything else held equal. In practice, this is not strictly true. The June 8, 1981 issue of Nuclear Fuel summarized the use of the VTAO. From this article, it is apparent that some utilities are selecting a low transaction tails assay as a method of reducing excess separative work commitments. Second, depending on how high DOE enrichment prices increased, DOE's customers might find it more economic to go abroad for their enrichment services. Recently, for the first time, enrichment services from EURODIF become less expensive than those from DOE. Implementing a split tails program has implications not only for the domestic uranium market, but also for the international uranium market and the domestic and international enrichment markets. And, while the primary effects can be identified and measured, the secondary and tertiary effects are less easily quantifiable, but can not be ignored.

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* This implicitly assumes that operating costs are at a minimum when the plants operate at full capacity.

4.2 "Reverse" Split Tails

One option with regard to changing the tails assays is to set the operating tails assay at 0.20 w/o and the transactional tails assay at 0.25 w/o. We have labelled this "reverse split tails" because while the two tails are different, their relationships would be reverse to what it was in the original split tails concept. A transactional tails assay of 0.25 w/o was selected because it is the maximum transactional tails that DOE can set without allowing its AFC customers to terminate their contracts without charge.

The effect on uranium feed requirements for "reverse" split tails is the same as for split tails. Again, because enrichment customers with AFC contracts can select the tails at which they deliver uranium due to the VTAO, the uranium demand for these customers is unaffected. For Requirements-type contract customers, however, uranium demand is increased by 8.9%. To the extent the weighted average tails assay selected by AFC customers is less than 0.25 w/o, total uranium demand would increase by less than this amount.

Although the increase in uranium feed requirements is the same for both the split tails and "reverse" split tails cases, the effect on demand on the domestic uranium producing industry is probably not. This is because, unlike the split tails program where the Government would most likely be procuring uranium directly from U.S. producers, in a "reverse" split tails program, DOE enrichment customers would be supplying the additional uranium (including foreign utilities perhaps supplying foreign uranium), and possibly buying only a small portion of it, because of their current large inventories which are expected to remain in excess of their needs for the next several years. Of course, removal of excess utility inventories which currently overhang the market would have a stabilizing effect on the uranium market.*

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* Also, U.S. utility preference for domestic versus foreign uranium largely disappears when purchases are made in the spot market.

With regard to direct purchases made to supply the additional uranium in reverse split tails, the utilities would not necessarily buy the entire amount from U.S. producers. They could also buy from other U.S. utilities or foreign sellers. Thus, in assessing the degree to which U.S. utilities would buy additional uranium from the domestic producing industry, it would be necessary to know (or make assumptions on) how they plan to dispose of their inventory and how much foreign versus domestic uranium they would buy. Further, with regard to domestic uranium, it would be necessary to determine the percentage they would buy from other U.S. utilities. Since the magnitude of the supplemental feed requirements is such that it could be purchased on the spot market, utilities and producers would compete fairly equally.* However, greater spot sales would put increased pressure on the spot market and increase the spot price, which is the main indicator of uranium prices. Any increased pressure in the spot market could cause U.S. utilities to enter into longer-term contracts for uranium which would benefit the U.S. producers.

Possible advantages to having utilities instead of the Government buying the additional uranium is that 1) further Government interference in the market is avoided, and 2) the utilities' excess inventories would be removed from the market. Possible disadvantages are that 1) it is unlikely that all of the additional feed requirements would be purchased from U.S. producers, and 2) the Government would not be able to "fine-tune" the market, assuming that the Government could better stabilize the uranium market than "free" market forces.

In this specific "reverse" split tails mode (where operating tails assay = 0.20 w/o) there is no effect on enrichment, but the Government builds up its inventory of natural uranium. Here, the subsidization of the uranium producing industry is quite clear, because the U.S. taxpayers are financing this inventory buildup and maintenance. Again, taxpayers may be willing to pay some sort of premium for uranium supply assurance, so they might be willing to pay such a subsidy. However, the cost of building and maintaining the inventory buildup would likely be quite large, especially if the Government took no action to reduce it in the future. If the Government did reduce this inventory in the future, its value (more or less) could be recovered.

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* Here we are talking about U.S. utilities. It is assumed that foreign utility customers of DOE would buy little of their excess feed requirements from U.S. producers.

We have seen the potential short-run benefits of "reverse" split tails on the uranium market and the potential short-run costs with regard to subsidizing this approach. We have also seen that these costs could be recovered over the longer run if the Government takes action to reduce the stockpile built up during the reverse split tails program. However, the disposal of the stock itself would have effects in the longer run period. If the Government went to a "normal" split tails mode to draw down this inventory, it would impact both the future uranium and enrichment markets. The main point is that if the Government utilized this additional stockpile in the future, this use would have some effect which would need to be accounted for in properly assessing this option. To the extent that it can not be accounted for, this longer-run effect would add uncertainty to the evaluation.

4.3 Raising the Unified Tails Assay

In the unified tails assay option, both the transactional and operating tails assay is set at 0.25 w/o. The effect of this action on the uranium market would basically be the same as the initial effect of reverse split tails. The Requirements-type contract holder would need to buy additional uranium feed from the market. In addition, the initial increase in uranium feed could be expected to come from excess consumer inventories. One possible difference between the unified assay option and reverse split tails would be the effect of increased SWU prices at operating tails of 0.25 w/o versus 0.20 w/o. As mentioned earlier, a higher enrichment price might cause AFC customers to select a higher tails assay and thus increase their demand for uranium. Also, domestic demand for foreign separative work could increase.

It is likely that raising the unified tails assay to 0.25 w/o would have a greater effect on the uranium market than reverse split tails with the operating tails at 0.25 w/o, although it is not clear that unified split tails would have a greater effect on the domestic uranium producing industry than split tails since DOE domestic customers could buy from foreign sources to meet this additional feed requirement. Unlike reverse split tails, the Government would not be building up inventory of uranium feed so there is no need to consider the possible long-run effects of disposition of this inventory. However, there would be an effect on the operation of the enrichment plants and the enrichment market, similar to those listed for the first option, split tails.

4.4 Comparison of the Alternative Tails Changes

Table 4.4.1 summarizes the various effects of the three options discussed in Subsections 4.1, 4.2 and 4.3. The effects are divided into those pertaining to the uranium market, those pertaining to the enrichment market, and those pertaining to the Government's operation of the enrichment plants. Each of these effects are differentiated between primary and secondary effects. By using this framework, the comparison between the different option is facilitated.

In reviewing the pros and cons of the options in the table, it is apparent that none of them are clearly superior to the others. The only conclusion that can be drawn is that there are mechanisms for increasing uranium demand by changing the operating and/or tails assays, but the cost/benefit relationship that results from any chosen alternative must be fully evaluated and compared before any program is implemented.

TABLE 4.4.1

SUMMARY COMPARISON OF ALTERNATIVE TAILS CHANGES

Option	Effect on Uranium Market	Effect on Enrichment Market	Effect On Government Enrichment Operations
1. Split Tails . 0.20 w/o Transactional Tails . 0.25 w/o Operating Tails	Primary · increases Government's need for uranium feed by 8.9% and its demand on the market, the magnitude depending on the Government's inventory policy · it is assumed that this demand would be filled by purchases from the domestic producing industry	Primary · decreases SWU requirements by 11.5% · increases the price of SWU	Primary · less utilization of plants · increase power demand charges
	Secondary · higher SWU prices could result in greater demand by AFC customers, as they would opt for a higher tails	Secondary · increased competition from foreign enrichers	Secondary · delayed requirements for new capacity
2. "Reverse" Split Tails · 0.25 w/o Transactional Tails · 0.20 w/o Operating Tails	Primary · increases feed requirements of DOE customers · would likely remove some excess inventories held by customers · direct purchases from domestic industry would be less than in split tails (assuming that Government only buys from domestic producers and it buys entire needs relating to split tails	Primary · no effect	Primary · build-up of inventories of uranium feed
	Secondary · possible disposal of stockpile could reduce market demand · lower demand can be expected by AFC customers than in 1 because of lower ratio of expected enrichment prices to expected feed prices	Secondary · no effect	Secondary · possible disposal of built-up inventories (and possible adoption of normal split tails operation)
3. Unified Tails Increase · 0.25 w/o Transactional Tails · 0.25 w/o Operating Tails	Primary · increases feed requirements of DOE customers · would likely remove some excess inventories held by customers · direct purchases from domestic industry would be less than in split tails (assuming that Government only buys from domestic producers and it buys entire needs relating to split tails)	Primary · decreases SWU requirements by 11.5% · increases the price of SWU	Primary · less utilization of plants · increased power demand charges
	Secondary · higher SWU prices could result in greater demand by AFC customers, as they would opt for a higher tails	Secondary · increased competition from foreign enrichers	Secondary · delayed requirements for new capacity

4.5 Specific Effects of a Tails Increase on the Uranium Market

We have discussed how a change in the tails assay could increase uranium feed requirements by 8.9%. Applying this percentage to a current estimate of required feed deliveries by U.S. customers to the DOE enrichment plants during the 1983-1990 period, the maximum effect of a tails change on uranium demand can be examined. We have assumed that 1983 is the earliest year that a tails assay change could be implemented. Consistent with our earlier discussions the tails assay change would be from 0.20 w/o to 0.25 w/o. Greater or lesser increases in tails could also be examined and the corresponding effects on feed requirements derived.

An increase in tails assay from 0.20 w/o to 0.25 w/o would increase total uranium feed requirements for the 1983-1990 period by approximately 15,700 short tons U_3O_8, assuming that AFC customers also selected the 0.25 w/o tails on which to base their feed deliveries (see Table 4.5.1). The annual increase in feed requirements for this period is approximately 2,000 tons. This amount represents the output of several small- to medium-sized domestic uranium producers. Another way of looking at this is that the total increase in feed requirements (keeping the same assumptions) by going to 0.25 w/o tails would be an amount more than the currently scheduled delivery commitments to domestic buyers from foreign sources. These commitments totalled 12,100 tons according to the 1981 Survey of United States Uranium Marketing Activity.

As pointed out earlier in this Section, the effect of an increase in feed requirements on the uranium market would be different, depending on whether the Government or the U.S. utilities were responsible for obtaining the additional feed. We noted that if the utilities were responsible for supplying the additional feed, they would likely draw-down their excess natural uranium inventories. Total uranium inventories of the U.S. utilities are estimated to be 62,700 tons at the end of 1982, approximately one-quarter of which are enriched uranium. The excess inventories that the utilities will be holding at this time can be derived by making assumptions on the level of inventories the utilities desire to hold and taking the difference between the projected actual level and the assumed desired level.

TABLE 4.5.1

EFFECT OF 0.25 w/o TAILS ON DOMESTIC URANIUM FEED REQUIREMENTS

(ST U_3O_8)

Calendar Year	Current Estimated Feed Requirements	Feed Requirements at 0.25 w/o Tails	Annual Increase in Feed Requirements	Cumulative Increase in Feed Requirements
1983	21,200	23,100	1,900	1,900
1984	21,600	23,500	1,900	3,800
1985	20,000	21,800	1,800	5,600
1986	17,700	19,300	1,600	7,200
1987	23,500	25,600	2,100	9,100
1988	23,400	25,500	2,100	11,200
1989	20,900	22,800	1,900	13,100
1990	26,600	29,000	2,400	15,500

For the purpose of this analysis, two levels of desired utility inventory holding will be examined--1.5 years of forward coverage and 2 years of forward coverage. Note that by increasing the tails assay to 0.25 w/o, the desired amount of inventory to be held also increases since the forward requirements increase. Thus, if utilities want to hold two years of forward coverage, at the end of 1982 they would hold 46,600 tons (equal to feed requirements for 1983 and 1984 at 0.25 w/o tails). The resulting exess inventory would be 16,100 tons (slightly more than the additional feed requirements for the 1981-1990 period) due to going to 0.25 w/o tails. On the other hand, if utilities only desired to hold 1.5 years of inventory, they would want to hold 34,900 tons at the end of 1982, and then would be holding an excess of 27,800 tons, approximately twice the level of the additional feed created by increasing the tails assay to 0.25 w/o.

It is implied above that the utilities would dispose of only their excess natural uranium inventories over this period. However, they could also reduce their inventories of enriched uranium. This reduction would decrease their excess inventories of natural uranium. Thus, less feed would be available from consumer stockpiles of natural uranium. However, due to the nature of enrichment contracts, significant reduction in enriched inventories could not be accomplished until the latter part of the 1980's. While identified, this affect has not been included in the analysis presented here.

EXHIBIT A

No. L-210
Tel. 973-3335 or
973-3446

FOR IMMEDIATE RELEASE
(Friday, September 6, 1968)

AEC ISSUES REVISED STATEMENT ON ITS URANIUM SUPPLY POLICIES

The Atomic Energy Commission will publish tomorrow in the Federal Register a revised statement of policies relating to uranium supply through June 30, 1973. These policies will apply to sales either of enriched uranium to be delivered no later than June 30, 1973, or of natural uranium to be subsequently toll enriched if the enriched uranium is to be delivered no later than June 30, 1973.

The AEC contemplates issuing in sufficient time for public comment the proposed terms and conditions applying to any sales of Government-owned uranium to meet a requirement for enriched uranium to be delivered after June 30, 1973.

A proposed statement on uranium supply policies was published in the Federal Register on November 9, 1967, with a request for public comments. The AEC received 26 letters of comment from uranium producers, utilities, and other persons interested in the nuclear power industry.

The comments were generally favorable to the proposed policies, with a majority of the suggestions being directed to the availability and price of uranium. Careful consideration was given to these comments in preparing the revised notice.

In the revised statement, the Commission reaffirms its preference for toll enrichment in AEC facilities of privately procured uranium over sale of either enriched or natural uranium from Government stocks at this time. The arrangement whereby privately owned uranium can be enriched in the isotope uranium-235 in Government facilities upon payment of a service charge is called toll enrichment.

The AEC is willing, under certain circumstances, however, to sell Government-owned uranium on a single transaction basis.

(more)

The price will be based on \$8 per pound of U_3O_8 in concentrates. Some of the letters of comment contained suggestions relating to possible escalation of the \$8 price. Although at this time the Commission sees no need to make provision for escalation, the matter will be considered again if conditions warrant. Sales of Government-owned enriched uranium will in general be limited to situations in which rapid delivery is required to meet unforeseen emergencies, where the material to be purchased is on lease from the AEC, or where small quantities are involved.

In other situations, the AEC will in general give preference to sale of natural uranium for toll enrichment rather than direct sale of enriched uranium. In such cases, any request for purchase of Government-owned uranium must be accompanied by evidence that the applicant has made a reasonable effort to purchase natural uranium from private domestic sources, and that it is not available on the required schedule or at a price not exceeding that being used as a basis for the AEC charge.

This notice differs from the previous notice in that it places preference on sale of natural uranium instead of enriched uranium if circumstances permit. Prospective purchasers are expected to present their requests sufficiently early to provide time for their needs to be met by purchase of uranium concentrates, conversion to uranium hexafluoride (UF_6) in private facilities, and toll enrichment.

No date has been established for removal of the restriction on the enrichment of foreign uranium intended for domestic use. It appears at this time, however, that it may be possible to remove the restriction by July 1, 1973, or earlier. The Commission intends to announce the proposed date as early as possible. Before reaching a decision on a date the Commission will provide opportunity for public comment. Consideration al will be given to the possibility of removing the restriction on a graduated scale.

A copy of the revised policy statement is attached.

(NOTE TO EDITORS AND CORRESPONDENTS: This information also is being issued by the Commission at its Grand Junction Office, Grand Junction, Colorado.)

Attachment:
Revised Statement on AEC
Uranium Supply Policies

APPENDIX

ATOMIC ENERGY COMMISSION

Statement on Uranium Supply Policies and Related Activities

BACKGROUND

1. In 1948 the AEC faced a critical shortage of uranium to meet the growing defense requirements for nuclear weapons. The principal sources of supply at that time, as during the war, were a single mine in the Belgian Congo and another on the Arctic Circle in Canada. Efforts were made to broaden the supply base to the maximum extent feasible. Exploration in Canada, undertaken in response to the defense requirement, subsequently turned up extensive deposits in northern Saskatchewan and southern Ontario, resulting in Canada becoming one of the world's leading uranium producers. Important production was also developed in South Africa which, under long-term contracts, delivered uranium to the U. S. through calendar year 1966. Lesser quantities of uranium were obtained from Portugal and Australia. One part of the AEC effort initiated in 1948 was to develop a domestic source of supply; toward this end, AEC established guaranteed price schedules and other incentives to stimulate private exploration. The stimulus so provided resulted in substantial uranium discoveries which were not only sufficient to make this country independent of foreign sources of supply, but raised the possibility of an overcommitment under the program. Therefore, in November 1958

the AEC limited its new purchase commitments to quantities based on domestic ore reserves developed prior to that date. The effect of this was to provide the domestic uranium industry with a substantial continuing market, but it extended only through 1966.

2. As late as 1962 deliveries under existing contracts were projected to exceed current requirements, yet it seemed probable that a large-scale civilian requirement for uranium would not develop for a number of years after 1966. Therefore, in November 1962, the Commission embarked on a stretch-out program providing for deferral until after 1966 of some of the deliveries under its procurement contracts, together with some additional purchases at a reduced price through 1970. As a result, deliveries in 1967-70 will be at a level of about 8,000 tons per year.

3. Although a reasonable balance between uranium purchases and requirements had been expected to result from the stretch-out program, decisions in 1964 and 1965 to reduce the rate of production of materials for nuclear weapons, together with the adoption of legislation permitting private ownership of special nuclear material and the commencement in 1969 of enrichment services to private owners of uranium, have resulted in a projected surplus of AEC-owned uranium over forecast Government requirements. On the other hand, the rapid growth in the rate of [illegible] for civilian nuclear power facilities has resulted [illegible] growing commercial market for uranium. Sales

already concluded for delivery through 1970, exclusive of AEC purchases, total about 18,000 tons.

4. During the past 24 months, orders for nuclear power plants in the United States have been placed at a more rapid rate than had been predicted. The AEC 1962 Report to the President[1/] foresaw a U. S. nuclear generating capacity of 40,000 MWe by 1980. Since that time, successive estimates have reflected increasing confidence in the ability of nuclear power plants to provide cheaper electric power in many areas of the country. In 1967, AEC projected installed domestic capacity by 1980 in the range of 120,000 to 170,000 MWe. If the midpoint of this range is taken as a basis, there is projected to be a cumulative U. S. U_3O_8 requirement for civilian power through 1980 of approximately 250,000 tons. The attached tabulation shows the 1967 AEC projection of nuclear growth and U_3O_8 requirements by years through 1980, as well as commercial sales of uranium concentrate reported to May 1968.

5. As a result of sales to the AEC under the stretch-out program and orders from commercial buyers, it appears that most of the domestic uranium producers will be operating at or near capacity through 1970. Under the impetus of increasing demand, the domestic market price of U_3O_8 has risen significantly over the past two years. Except for some remaining uncertainty as to the size of the commercial market in the first two or three

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[1/] "Civilian Nuclear Power...a Report to the President - 1962," USAEC years following expiration of AEC purchase contracts in 1970, a relatively smooth transition from a Government to a private market now seems reasonably certain.

6. These developments are resulting in a rapid expansion in the level of exploration for additional reserves, which is essential to the evolution of a stable nuclear fuel market. Although some additions to reserves are anticipated in the near future, it may be a few years before the full effect of this effort on U. S. reserves can be assessed. Meanwhile, the substantial demand and rising prices have resulted in increased interest by consumers in the possible purchase of enriched uranium from the AEC.

PREVIOUSLY ANNOUNCED AEC POLICIES ON SUPPLY OF URANIUM

7. The Commission has given careful consideration over an extended period to its uranium supply policies. Extensive hearings were held before the Joint Committee on Atomic Energy during consideration of the Private Ownership of Special Nuclear Materials legislation in 1964 and of the Uranium Enrichment Services Criteria in 1966. The policies were again reviewed in the AEC Authorization Hearings in 1967. Restatement and clarification of these policies was believed desirable in the light of the rapidly changing uranium supply and demand situation. Therefore, the Commission invited public comment on a Proposed Statement on Uranium Supply Policies and Related Activities published in the Federal Register on November 9, 1967

(32 F.R. [illegible]). The comments received were given careful consideration in the preparation of this revised notice.

8. The major objectives of the Commission's supply policies as announced on July 25, 1966, and in the Uranium Enrichment Services Criteria established on December 23, 1966 (31 F.R. 16479), were: (1) to establish toll enrichment as the preferred means for obtaining enriched uranium from the AEC, (2) to help assure a viable domestic uranium mining and milling industry, and (3) to provide incentives to private industry to undertake the early expansion of exploration and development of the large uranium ore reserves and production capability required to supply the expected demand for nuclear fuel for civilian power reactors.

9. The outstanding policies were:

(a) The natural uranium component of the AEC schedule of charges for lease and sale of enriched uranium would continue to be based upon a price of $8 per pound of U_3O_8, at least through June 30, 1973.

(b) Sales of enriched uranium would be limited to single transactions, rather than long-term contracts, except where provisions for long-term sales are included in Agreements for Cooperation with foreign nations. A further exception would be made in the case of distributions to domestic customers of enriched uranium to be used in a research and development program involving production of U-233 when lease is not available and during the period when a guaranteed purchase price is in effect for U-233. In Agreements for Cooperation providing for supply of enriched uranium via toll enriching, the AEC would also agree to furnish, for an appropriate charge, the natural uranium for a toll enrichment transaction where the foreign party has determined that the required natural uranium is not reasonably available to him.

(c) While quantitative criteria could not be specified, the disposal of AEC's available feed stocks would not be undertaken until it could be done in a manner which would not adversely affect the general viability of the domestic uranium industry.

(d) Beginning January 1, 1971, enriched uranium on lease may be converted to private ownership by a mechanism, called "in situ" toll enriching, under which the lessee would furnish to the AEC specified amounts of uranium feed and dollars and would thereby acquire ownership of the leased material.

(e) The transition to private ownership of all material held or being procured by licensees for power reactor use would be accomplished by AEC's terminating distributions of such material by lease on December 31, 1970, and terminating outstanding leases for such material on June 30, 1973. These are the same dates which are already applicable under the Atomic Energy Act of 1954, as amended, to distribution of such material to power reactor operators. However, AEC would, on a case-by-case basis, consider requests by U. S. fabricators for deferred payment of enriching service charges on toll enriched material -- at an interest charge on the unpaid balance equal to the then-current use charge rate -- during a fabrication period of up to one year.

In addition, and as stated in the Uranium Enrichment Services Criteria (pursuant to Section 161v of the Atomic Energy Act of 1954, as amended), in order to assure the maintenance of a viable domestic uranium industry, AEC would not agree to enrich foreign uranium intended for use in domestic facilities. AEC would, from time to time, review the status of the domestic mining and milling industry to determine the need to continue this restriction.

PROCEDURES FOR IMPLEMENTING POLICIES ON SALE OF ENRICHED AND NATURAL URANIUM

10. The Commission reaffirms its policy that the preferred method for industry to secure enriched uranium is through toll enrichment of uranium procured from private sources. However, in the circumstances set forth below the Commission is willing to sell Government-owned uranium on a single transaction basis. The Commission is also willing to sell Government-owned uranium on other than a single transaction basis in cases of distribution to domestic customers enriched uranium to be used in a research and development

program involving production of U-233 when lease is not available and during the period when a guaranteed purchase price is in effect for U-233. Sales contracts normally would not be executed more than 18 months in advance of the date the uranium is required. However, consideration will be given to executing sales contracts providing for a longer interval if the purchaser is in a position to justify the necessity for such longer interval. This policy, and the terms and conditions pertaining thereto, will apply to AEC sales either of enriched uranium to be delivered no later than June 30, 1973, or of natural uranium to be subsequently toll enriched if the enriched uranium is to be delivered no later than June 30, 1973. The AEC contemplates issuing in sufficient time for public comment, the proposed terms and conditions applying to any sales of Government-owned uranium to meet a requirement for enriched uranium to be delivered after that date.

11. Any sales of Government-owned uranium under this policy will be at a charge based on $8 per pound of U_3O_8 in concentrates. The question of escalation has been raised in some of the comments received on the Federal Register Notice of November 9, 1967, but at this time the Commission sees no need to make provisions for escalation. However, the matter will be considered again if conditions warrant.

12. The Commission reaffirms its willingness to sell enriched uranium on a single transaction basis. Such sales of enriched uranium will in general be limited to situations

in which rapid delivery is required to meet unforeseen emergencies, where the material to be purchased has been distributed by the Commission on lease, or where the quantity desired is small enough that undue effort would be involved in securing the material through toll enrichment. The charge for enriched uranium sold will be that in effect on the date of delivery. The natural uranium feed component in the schedule of charges for lease or sale of enriched uranium will continue to be based on $8 per pound of U_3O_8, at least through June 30, 1973. As stated in the Uranium Enrichment Services Criteria the separative work component in the schedule of charges for lease or sale will be the same as the charge per unit of separative work concurrently in effect for enriching services.

13. In other situations, however, involving the sale of Government-owned uranium, AEC will in general give preference to the sale of natural uranium for toll enrichment rather than direct sale of enriched uranium. In such cases, any request for purchase of Government-owned uranium must be accompanied by evidence that the applicant has made a reasonable effort to purchase natural uranium from private domestic sources and that it is not available on the required schedule or at a price not exceeding that being used as a basis for the AEC charge. Except in cases of unforeseen emergency, prospective purchasers of Government-owned uranium must present their request sufficiently early to provide time

for their needs to be met by purchase of Government-owned uranium concentrates for conversion to UF_6 in private facilities followed by toll enrichment. Sale of such Government-owned uranium will be limited to that amount of material required for up to an initial core or a single replacement region of a core (including allowance for spare elements, losses in processing, fabrication, etc.) for a specific power reactor.

14. Sales of Government-owned uranium, as discussed in the preceding paragraphs, will be subject to the availability of such material. The amount available from AEC will depend on the quantities needed to meet Government requirements and on the extent to which it is considered desirable to maintain a Government reserve. Disposition of enriched and natural uranium by the means stated herein is not expected to be of major significance either in terms of tonnage removed from stocks or of competition with the domestic uranium industry. The quantity of uranium which would be available, therefore, appears ample at this time to meet the expected demand upon AEC stocks under this program.

15. Foreign as well as domestic customers may purchase enriched or natural uranium on the basis outlined above. Foreign sales policies, and the arrangements made pursuant to Agreements for Cooperation are not affected by the policies set out in this Notice.

REMOVAL OF RESTRICTIONS ON ENRICHMENT OF FOREIGN URANIUM FOR DOMESTIC USE

16. No date has been established for removal of the restriction on the enrichment of foreign uranium intended for domestic use, but in the 1966 review it was generally considered that this might be done by the mid-1970's. The Commission will continue to review this restriction in the light of developments and will propose its removal at the earliest date consistent with reasonable assurance of the viability of the domestic uranium industry as a whole. At the present time it appears that this may be possible by July 1, 1973, or earlier. The Commission intends to announce this proposed date as early as possible. The Commission will also give consideration to the possibility of removing the restriction on a graduated schedule.

17. The Commission does not believe it feasible to define quantitatively in advance the criteria which in its judgment would characterize a viable industry. Although the size of the market is an important element, a number of other factors must also be considered, such as the price of uranium at the time restrictions are removed, the size of domestic ore reserves, the rate of development of new reserves, the probable penetration of the domestic market by foreign imports, and the size of the export market. A decision that the restriction can be removed on a specified date or schedule would constitute a proposed amendment to the Uranium

Enrichment Services Criteria which, before being established, would be submitted for Congressional review in accordance with Section 161v of the Atomic Energy Act. Prior to reaching such a decision the Commission plans to provide opportunity for public comment.

LONG-TERM AVAILABILITY OF URANIUM

18. In addition to its responsibility to see that its uranium supply policies adequately meet the needs of the various segments of the nuclear energy industry in the near term, the Commission is charged with assisting in the effective long-term development of nuclear energy. The availability of adequate fuel supplies is critical to the continued development of this important energy source. The Commission believes, therefore, that it should help assure adequate fuel resources through a program of resource evaluation and technical support to private exploration and through a vigorous reactor development program aimed at extending the supply of low-cost nuclear fuel resources through more efficient use.

19. A reevaluation of the long-term supply picture makes it apparent that the effort required by the uranium mining industry to meet the projected demand will be even greater than foreseen two years ago. The uranium industry faces potential domestic commercial requirements for delivery through 1980 approaching 250,000 tons of U_3O_8 (exclusive of

AEC purchases), although this demand would be reduced to the extent of AEC sales of uranium to industry. An eight-year ore reserve in 1980, which is considered to be the minimum to support the continued expansion of production required, would be about 400,000 tons. Thus, during the period through 1980 production plus reserves would be about 650,000 tons of U_3O_8, which will require new discoveries exceeding 500,000 tons (presently known reserves at prices up to $8 per pound are about 150,000 tons).

20. Mining and milling capacities will have to be expanded to a production capability of nearly 40,000 tons per year by 1980 if U. S. requirements are to be met from domestic sources. The total investment in exploration and production facilities required is estimated in excess of $1 billion. This would represent an investment requirement of more than $2 per pound of U_3O_8 sold during the 1967-80 period. If consumers wish to negotiate long-term supply contracts committing reserves 8 to 10 years or more in the future, larger ore reserves would be needed and the exploration investment would be greater.

21. The Commission considers it important that information on uranium availability resulting from uranium exploration by private industry be collected and evaluated on a continuing basis. Such information on uranium reserves and resources is required for sound long-range planning of nuclear power development by both Government and industry.

The Commission also believes that, in view of the large quantities of uranium that must be found and produced in the years ahead and the great potential savings in the cost of power if low uranium costs can be maintained, it is important that there be an adequate program of research and development to achieve an improved understanding of the occurrence, characteristics, and distribution of uranium ore deposits, the underlying ore-forming processes, and the technology of discovery and exploitation. AEC-sponsored projects of a type not undertaken by industry, and appropriate effort by other agencies, particularly mapping of areas favorable for uranium by the U. S. Geological Survey, are believed essential to this end.

22. Means of extending low-cost nuclear fuel resources are being actively pursued. The primary approach, and the ultimate solution, to the problem of extending fuel resources is the development of breeder reactors which make more fissionable material than they burn. An efficient fast breeder reactor would make it possible to utilize most of the energy latent in uranium and permit the economic use of higher priced fuel. Pending availability of fast breeders, interim measures to conserve available uranium-235 may include advanced converter systems which use fuel more

PROJECTED NUCLEAR POWER GROWTH
COMMERCIAL URANIUM REQUIREMENTS AND SALES BY YEARS

	Installed Capacity in Net Electrical Megawatts	Domestic Requirements (Short Tons of U_3O_8) 1/	
		Annual	Cumulative
1966	1,800	1,500	1,500
1967	2,800	2,300	3,800
1968	3,900	4,000	7,800
1969	6,600	5,600	13,400
1970	9,800	7,500	20,900
1971	16,500	9,200	30,100
1972	23,000	12,500	42,600
1973	33,000	14,300	57,000
1974	47,000	15,000	72,000
1975	61,000	21,000	93,000
1976	74,000	24,000	117,000
1977	91,000	26,000	143,000
1978	108,000	30,000	173,000
1979	124,000	34,000	207,000
1980	145,000	38,000	245,000

Domestic Sales and Contract Commitments
(Excludes AEC Purchases)
(Tons of U_3O_8 - by Year of Delivery)

	Annual	Cumulative
Pre-1968	900	900
1968	5,300	6,200
1969	4,500	10,700
1970	7,500	18,200
1971	9,800	28,000
1972	10,500	38,500
1973	7,900	46,400
1974	6,000	52,400
1975-77	6,200	58,600

Foreign Sales and Contract Commitments
by Domestic Producers

Total	3,100

1/ Requirements each year include initial fuel for reactors under construction and makeup fuel for reactors constructed in prior years, the latter varying from about 15% of total annual requirements in 1966 to 60% in 1980. The computations involve assumptions about fuel-processing times and utilize reactor characteristics supplied by reactor manufacturers. The tails essay in the uranium enrichment plants is taken as 0.2% U-235. Plutonium recycle in thermal reactors is assumed to start in 1974, resulting in a reduction in annual requirements for U_3O_8 ranging from about 2% in 1973 to 12% in 1980.

efficiently than the present generation of light water moderated reactors.

Dated at Washington, D. C., this 3rd day of September, 1968.

FOR THE ATOMIC ENERGY COMMISSION

/s/ W. B. McCool
W. B. McCool
Secretary to the Commission

EXHIBIT B

Excerpts from AEC Authorization Hearings before the JOINT COMMITTEE ON ATOMIC ENERGY

March and May 1971

3. Supplemental Charges.—Supplemental charges to be paid the Commission by WPPSS during each contract year will be limited to a maximum amount equivalent to the difference between twenty million dollars and the sum of the charges for availability of steam energy under the Principal Contract during those periods ($717,000, FY 72; $917,000, FY 73; $6,250,000, FY 74) and the costs incurred by the Commission, not to exceed $125,000, for maintenance of certain items located in the NPR which were funded by WPPSS pursuant to the Principal Contract. Provisional payment of the supplemental charges will be made in advance in monthly installments subject to appropriate reduction to the extent that the NPR is not available for the production of steam energy in an amount equivalent to 4 billion Kwhe per year, or that the costs attributable to the Commission's undertaking are less than sixty million dollars.

4. Costs Attributable.—Costs attributable to the undertaking of the Commission will be (with the exception of the costs of preparing and fabricating enriched uranium into NPR fuel, operating and maintaining the NPR incurred prior to July 1, 1971 and depreciation on plant and equipment) the costs in excess of $450,000 per contract year incurred or projected to be incurred by the Commission prior to, during, and after the term of the contract and attributable thereto as unilaterally determined by the Commission in accordance with its established accounting policy less an amount equivalent to $9.28 times the number of grams of recoverable plutonium isotopes Pu-239 and Pu-241 produced in NPR operations during the period of the contract.

5. Miscellaneous Provisions.—The contract will contain the usual provisions concerning such matters as disputes, security, equal opportunity, etc.

The $1.5 million construction item is for additional facilities which, when completed, will result in a more economical operation of the chemical separations plants at Richland. We are requesting an appropriation of $3 million more than the authorization amount in order to provide an additional waste tank under Project 70-1-a, Waste Storage Tanks and Tank Farm Waste Handling System. This project was authorized in fiscal year 1970 in the amount of $10 million but to date only $6.5 million has been appropriated.

INCREASE IN DIFFUSION PLANT TAILS ASSAY

Our second request for an increase in authorization in the nuclear materials program relates to our recent decision announced last Friday to increase the operating tails assay of our uranium enrichment plants. As we informed you by letter dated May 5, 1971, we have been reviewing the U^{235} assay of the tails stream upon which the operation of the gaseous diffusion plants is based in view of the actual and projected increases in the cost of electricity to these plants. This tails assay determines the relative requirements for separative work and uranium feed for the production of enriched uranium in the plants. The review is now completed and we have concluded that the operating tails assay should be increased from its present level of 0.20 percent U^{235} to the higher level of 0.30 percent for 2 years beginning about July 1, 1971.

This increase in operating tails assay will avoid the risk of operating at the tails assay below that which later might be determined to be economically desirable and will result in increased availability of preproduction stocks. This action is proposed in the context of longer term planning which assumes the future refeeding of the 0.30-percent tails as warranted by economic considerations.

Although we plan to increase the operating tails assay to 0.30 percent as noted, we believe that the toll-enriching tails assay established in the Standard Table of Enriching Services as the basis for uranium enrichment services transactions should be maintained at its present level of 0.20 percent during the same 2-year period. During this period we will be filling tol[illegible]chment requirements from preproduction stocks already produced at the 0.20-percent tails assay.

FUTURE TAILS ASSAY LEVEL

Beginning about July 1, 1973, we plan to increase the toll-enriching tails assay (in the Standard Table of Enriching Services) from 0.20 percent to a level which will depend on conditions at that time. Such a level depends, in a complex way, upon future estimates of demand, availability of capacity, costs of power, costs of natural uranium and other factors.

Accordingly, we do not wish to prejudge such future level by establishing it now for future application. To assist industry planning, however, we suggest the use of a projected tails assay of approximately 0.25 percent. The resulting schedule of toll enrichment transactions at 0.25 percent beginning in fiscal year 1974 is compatible with the announced $32 charge for separative work.

The planned change in the mode of operating the gaseous diffusion plants will require an increase in authorization for this program of $8.8 million in operating costs and related GSO and $0.4 million in capital equipment obligations. The increase in operating costs will be incurred in preparing the additional UF_6 feed needed to sustain operations at the higher tails assay. Since there is no concurrent increase in the tails assay for toll enrichers, all of the additional feed required must be supplied from AEC stocks. The increase in capital equipment is needed to provide for changed requirements in shipping containers used for intersite shipments which result from the changes in operating conditions.

Representative HOSMER. What do you mean by that? Do you have to have new containers?

Dr. SEABORG. The increase in tails assay results in a slightly higher enrichment of the product from the Paducah gaseous diffusion cascade and therefore protective packaging is needed in order to insure safety.

Representative HOSMER. Wait a minute. That does not make sense to me. You are going to have an increase in the tails assay——

Dr. SEABORG. Not in the tails assay. In the U^{235}, itself, that comes out of the Paducah plant. This is a consequence of economic planning in connection with the increase in the tails assay, so that the product from the Paducah plant comes out at 1.4 percent instead of 1.05 percent. It is an increase in the enrichment of the product from the Paducah plant. Then in order to meet our standards of safety in the protective packaging we need to make some changes that will result in an increase in cost.

Representative HOSMER. So you have to have a different container?

Dr. SEABORG. Yes; we have to modify the container.

Representative HOSMER. The product you are talking about is what eventually is being sold to the customer?

Dr. SEABORG. Well, not at this low enrichment, no. It is part of the overall cycle. Paducah feeds Portsmouth.

Representative HOSMER. This is the stuff that goes in storage then?

Mr. QUINN. It is part of the interplant flow. We have the three diffusion plants. They are operated in an integrated fashion. The Paducah plant product is fed to both the Oak Ridge and the Portsmouth cascades for further enrichment.

The U^{235} assay of the Paducah plant product will be higher as a result of this increase in the tails assay and this requires the change in the shipping containers.

Representative Holifield. In other words, you have to have more shipping containers in order to take care of the 0.3 percent tails assay than the 0.2.

Mr. Quinn. Not more, Mr. Holifield; it is that at the higher assay, different regulations apply for safety in transport. This requires a modification in the shipping container.

Representative Holifield. Are you replacing the old container with a different, new, and stronger container?

Mr. Quinn. It is a different packaging of a container.

Representative Hosmer. Has it to do with approaching a critical mass?

Mr. Quinn. To protect against that.

Representative Holifield. The end result is that you are going to have to have more funds to buy new and different containers?

Mr. Quinn. $400,000.

Representative Holifield. $400,000?

Mr. Quinn. Yes, sir.

Representative Holifield. In order to contain this new product. Now has that expenditure been figured into the cost of this operation of extracting 0.4 percent of the U^{235} rather than 0.5 percent?

Mr. Quinn. I am sure it is covered within the $32 charge; yes, sir.

EFFECT OF INCREASE IN TAILS ASSAY

Representative Holifield. Are you saying to the committee that you can extract 0.4 percent more economically than you can 0.5 percent?

Mr. Quinn. I am not sure I understand your question.

Representative Holifield. Let us put it the other way; 0.3 percent tails assay in place of 0.2. It is the same thing. You continually talk about increasing the tails assay. What you are talking about is a reduction in the extraction of U^{235}. Does this reduce the enriched material which is available for utilization?

Mr. Quinn. No, sir, the increase in the tails assay actually increases the amount of enriched product available for utilization.

Dr. Seaborg. For a given amount of separative work.

Representative Holifield. You mean the 0.1 percent more that is left in the tails is not a deduction from the total when you are extracting 0.4 percent? Are you going to feed more material in order to get that 0.4 percent?

Mr. Quinn. We have to increase the feed to the plant.

Representative Hosmer. Could you not overcome this problem and avoid the expenditure of the $400,000 simply by reducing the level at which you fill the container or by putting cheap separators around the containers so that you keep them farther apart?

Mr. Quinn. The protective packaging takes care of that latter aspect. To fill the containers to a lesser degree would mean we would have to use more containers. That would probably cost more.

Representative Hosmer. If you sell that stuff faster you will probably have a lot of empty containers anyway.

Mr. Quinn. This material is not directly sold. It is used as feed to the other two cascades.

Representative Holifield. It still has to be processed if you get that other one-tenth of a percent out. You are stopping the processing sooner, as I understand it. The time of processing of a given material, you are stopping that process at a four-tenths of a percent extraction rather than at a five-tenths of a percent extraction, is that right?

Dr. SEABORG. No, three-tenths.

Representative HOLIFIELD. I guess we are talking from different ends of the spectrum.

Mr. QUINN. We are not stripping the feed of U^{235} as much as we would if——

Representative HOLIFIELD. That is right. We have been stripping it at the rate of 0.5 percent, is that right.

Mr. QUINN. Yes, sir.

Representative HOLIFIELD. We are now going to strip it at the rate of 0.4 percent.

Mr. QUINN. Yes, sir.

Representative HOLIFIELD. That means in the place of having the 0.2 percent left in the tails assay you are going to have 0.3 percent?

Mr. QUINN. Yes, sir.

Representative HOLIFIELD. If you are going to that, you are going to have to process the three-tenths tails at some future time to get the U^{235} out of the tails, just the same as you would have had to process it to get to the two-tenths of a percent the first time through.

INFLUENCE OF INCREASED ELECTRIC POWER COSTS

Mr. QUINN. Mr. Holifield, it is not economic to strip the tails as far as we have in the past as a result of our higher cost of separative work, principally because of the higher charges for electric power.

Representative HOLIFIELD. I don't understand that because your electric power is going to get higher and higher. When you get to the point when you want to strip that other tenth of a percent out which you are now depositing in the tails assay you don't know what cost of electricity is going to be and it may be a lot higher than it is today.

Mr. QUINN. If it is higher then perhaps we should be operating at even a higher tails assay today because the degree to which we can afford to strip is very sensitive to the cost of electricity.

Representative HOLIFIELD. I understand that.

Mr. QUINN. The higher the cost of electricity the higher is the optimum tails assay.

Representative HOLIFIELD. I understand that.

Representative HOSMER. You can save a lot of money by going all the way to the natural uranium reactor I suppose?

Dr. SEABORG. To the limit if the cost of electricity went up high enough, yes. It is not likely.

Chairman PASTORE. Did the fact that we appropriated $16 million for the cascade improvement program, which has been frozen, initiate this new program of yours?

Mr. QUINN. No, sir, it has not.

Chairman PASTORE. Is this an alternative?

Mr. QUINN. No, sir. The decision was because of an increase in the cost of electricity; we would increase the tails assay in any event.

Chairman PASTORE. No matter what?

Mr. QUINN. No matter what. The decision to go to the three-tenths is because of uncertainty as to what future costs are going to be.

Chairman PASTORE. Does this account for the price going up from $26 to $32?

Mr. **QUINN**. No, sir, not at all. The increased cost of electricity played a large role in that increase in the charge.

Chairman **PASTORE**. In other words, if we didn't do this and you kept selling it at $26 you would be losing money?

Mr. **QUINN**. Yes, sir.

Representative **HOSMER**. Don't you claim, however, that by going up on the tails assay you delay by about 6 months the day at which new enrichment capacity is required, whatever that day might be?

Mr. **QUINN**. For everything else being the same, power additions, improvement program schedules, and so forth, there would be a delay in the new plant date by about 6 months.

Representative **HOSMER**. Somebody has been using that as an argument to keep the $16 million locked up, I understand .

Chairman **PASTORE**. He just said "No." Is that true?

Mr. **QUINN**. I don't believe so, Mr. Hosmer.

Representative **HOSMER**. They are taking this delay into account down at the Office of Management and Budget when they continually say "No, no, no."

CONSEQUENCE OF HIGHER TAILS ASSAY

Dr. **SEABORG**. The consequence of increasing the tails assay in order to effect this economic operation that results from the increase in the cost of electricity is to increase preproduction.

Representative **HOLIFIELD**. Preproduction of enriched material?

Mr. **QUINN**. Of enriched material.

Representative **HOLIFIELD**. Because you are preproducing at a higher rate than you are selling it at the present time. So you are changing the inventory of yellow cake, you might say, into an inventory of enriched uranium.

Dr. **SEABORG**. Yes, sir.

Representative **HOLIFIELD**. As a parallel to that you are also leaving uranium-235 in the tails, 50 percent more.

Dr. **SEABORG**. Yes. But at a level that it would be uneconomic to decrease. It may never be economic to go down to two-tenths of a percent tails again. In other words, we may never strip to two-tenths again. But we have the flexibility in the future of stripping the three-tenths to whatever level is economic.

What we don't want to do is strip lower than what is economic because that represents a permanent loss of electricity; as a matter of fact, we probably have been operating at an uneconomic level for some time now by stripping to two-tenths percent.

Chairman **PASTORE**. When you go from 0.2 to 0.3 does that mean you use less electricity?

Dr. **SEABORG**. You get more product for the same amount of electricity at the expense of more feed.

Representative **HOLIFIELD**. By reducing your inventory of yellow cake. In other words, you can do this as long as we have a surplus inventory of yellow cake. But when you get that used up at this faster rate, then you will be in a different situation as I understand it then you would be if you processed the material more completely.

Dr. **SEABORG**. Yes. Then industry would sell more uranium.

Mr. **QUINN**. Mr. Holifield, the additional feed that is used results in additional preproduction as we have discussed.

Representative **HOLIFIELD**. Yes; I understand that.

Mr. **Quinn**. When that preproduction is distributed to the utilities under toll enriching contracts, they bring in feed material to replace that which we use in producing that enriched material.

Representative **Holifield**. Provided they don't want to buy it from you.

Mr. **Quinn**. Well, our basic policy is to provide an enrichment service rather than selling enriched material per se.

Representative **Holifield**. At that point after you do toll enrichment of the utility material, they have the privilege of taking that 0.3 percent tails themselves or of leaving it with you, is that right?

ACQUISITION OF TAILS MATERIALS BY TOLL ENRICHING CUSTOMERS

Mr. **Quinn**. They have an option of acquiring tails material in conjunction with their transaction.

Now during this 2-year period, toll enriching transactions will continue to be on the basis of two-tenths tails while we use up the existing preproduction material which was produced at that level. If they request tails during that period they will be supplied with material at the two-tenths assay of which we have substantial stocks.

Representative **Holifield**. Not at the three-tenths.

Dr. **Seaborg**. Not during these 2 years because we have 2 years supply of material that we are furnishing to utilities produced while the plant was operating at two-tenths percent tails.

Representative **Hosmer**. You still are not saying what you are going to give them after the 2 years is over? It all depends on what the hocus-pocus is 2 years from now.

Dr. **Seaborg**. The price of electricity and price of uranium.

Representative **Hosmer**. In the good old days you could have been preproducing it at previously lower electric charges but under the Johnson and the Nixon administrations people have been cutting out the purchase of power for the preproduction.

We didn't fill our treasure house when we could have.

Dr. **Seaborg**. You have to strike an optimum there between the cost of spending money prematurely——

Representative **Hosmer**. Money was cheap then too.

Dr. **Seaborg**. There was still an interest rate that had to be taken into account.

Mr. **Ramey**. I recall there were some of us who would have preferred that we not go down as low in our production.

Representative **Hosmer**. We were overruled, weren't we?

Mr. **Ramey**. Yes, sir, we were.

Representative **Hosmer**. One thing I don't understand, is whether we get a credit or debit on the yellow cake that is being converted into UF_6, which it costs us $6.6 million to do.

Then you beat a little of the enriched uranium out of it and you let it lie around after that as three-tenths tails. It must have some difference in value after that than it had before.

I don't see that reflected in these calculations that you have given use. Nor do I see any debit at all for the disappearance of this yellow cake from the stockpile.

USE OF SURPLUS URANIUM

Mr. QUINN. Mr. Hosmer, the surplus uranium that will be used to feed the plant while we are running at this higher tails assay will be converted to UF$_6$.

As I explained earlier, eventually when that preproduced material is distributed to the utilities that quantity of feed will be regenerated in the form of UF$_6$. What this means in the net then, is that surplus uranium that we sell in the future, this amount of it, will be sold as UF$_6$ rather than as U$_3$O$_8$.

Representative HOSMER. In accordance with your accounting methods you are not losing any value all the way through and anything that disappears to the purchaser is being accounted for in this revenue-supply figure?

Mr. QUINN. No, sir, we should not in the long run have any loss there.

Representative HOSMER. Do you plan to use up the stockpile in this 2-year period?

Mr. QUINN. No, sir.

Representative HOSMER. You are still going to have part of the problem left then?

Mr. QUINN. Yes.

Representative HOLIFIELD. How much stockpile do we have? Is that available? Will you furnish the committee with the amount of stockpile that we have?

Mr. QUINN. Allowing for the projected government requirement in the future, we have estimated that the amount of surplus is the equivalent of 50,000 tons of U^{235}.

IMPORTATION OF FOREIGN ORES

Representative HOSMER. Isn't it relevant for us to hear something in this connection in regard to the toll enrichment problem and the embargo on foreign ores and things like that, or is that so far from this particular point that we need not even bring it up today?

Dr. SEABORG. We don't have a plan yet to present to you. That is still under discussion.

Representative HOSMER. I know, but all of this relates to the management of the stockpile. It certainly relates to what the tails assay is established to be, and all of these financial factors on the raw materials side of the picture bring us into the raw materials importation question and things like that.

I do not like to open up a pandora's box and I am not going to ask you to discuss it but I point out that logically it is a relevant subject and we are going to have to face up to it sometime.

Representative HOLIFIELD. I would like to ask a question here, Mr. Chairman. If there are continued delays in the funding of the CIP would the Commission increase the tails assay in 1973 to higher than optimum level?

Chairman PASTORE. In plain English what does that mean? Go back to the 0.2 percent?

Representative HOLIFIELD. I mean increase the tails assay. You don't go back to 0.2; you go up to 0.3 or 0.4 percent.

Dr. SEABORG. The plan in 1973 is to change the tails from three-tenths percent to whatever the optimum level is at that time, taking into account the price of electricity, the price of uranium and so forth. Most likely this will be a decrease.

Chairman **Pastore**. What does that decrease mean, stated in percentage?

Dr. **Seaborg**. What we are suggesting to industry is that they plan on the basis that we will go to a point two five (.25) tails assay.

Chairman **Pastore**. You come down from 0.3?

Dr. **Seaborg**. Yes.

POSSIBLE ACTION TO BE TAKEN IF PLANT DISABLED FOR 6 MONTHS

Representative **Hosmer**. May I put this in the form of a hypothetical situation.

Suppose that at Paducah or Oak Ridge or Portsmouth you had a major incident which interrupted production of one of those plants for 6 months. Assume that occurred on July 1, 1971.

What would you have to do, or could you do anything, to completely overcome the interruption by the time that additional capacity would have to be on the line, so that the scheduling of the capacity increases would not have to be disturbed?

Dr. **Larson**. Do you mean a permanent outage or for 1 year?

Representative **Hosmer**. I am talking about a major incident at one of these plants for 6 months, a particular plant.

Chairman **Pastore**. Either in 1971 or November 1972, you can have it any way you want it.

Representative **Holifield**. Let us not have a specific withdrawal date. Let us make this a 6-month period.

Dr. **Larson**. You would immediately feed more electricity to the other two plants.

Representative **Hosmer**. Where did you say that was coming from?

Dr. **Larson**. The electricity?

Representative **Hosmer**. Yes, sir.

Dr. **Larson**. The plants are all intertied.

Representative **Hosmer**. Can you get it out of the Con Edison system?

Dr. **Larson**. No. You have interties.

Mr. **Quinn**. Mr. Hosmer, to the extent that the transmission lines would permit, the power that would have been used in the disabled plant would be moved to those still operating and that would at least in part compensate for that outage.

Representative **Hosmer**. What I am trying to bring up here is the fact that you keep giving away the little fat we have between now and this date by which we have to have new enrichment capacity, and nobody has tried to give us a real hypothecation of what would happen if we really hit a bad one where we had a plant breakdown or a serious and long-term interruption of the production of separative work units.

Mr. **Quinn**. The new plant date is 1981 or 1982. The thing that could be done would be to reinstate power to the three plants at a more rapid rate than we otherwise would to compensate for that loss.

Representative **Hosmer**. When we run into that you have to bring up the factor of where the power is coming from. As far as I can see everybody is short on power. You can move it a long way and you can use what you would be using in one of the plants at the two others, but how well and how effectively and how much you could overcome production shortages, I don't know.

I am trying to force something on the record to recognize that this kind of problem exists and that it has not been discussed, and it ought to be discussed.

If you would like to put a statement in the record about it I would ask unanimous consent that you have permission to do so.

Dr. **Seaborg**. A statement as to what we would do if there were a 6-month shutdown to one of the plants due to an accident?

Representative **Hosmer**. Yes.

Dr. **Seaborg**. We will try to do that.

(The statement referred to follows on p. 2472.)

Representative **Holifield**. It would seem the common sense answer to that would be, as Mr. Quinn has said, that you would transmit the unused power from let us say the Paducah plant, if it is the one where the incident occurred, over to the Oak Ridge plant.

Dr. **Seaborg**. Yes.

Representative **Holifield**. You could do that as long as the Oak Ridge plant was not working to capacity.

Dr. **Seaborg**. That is right.

Representative **Holifield**. But if the Portsmouth and the Oak Ridge plants were working to capacity, as they will and should be later in this decade, then there would be no place to transfer that power. There would be a loss in overall production as I understand.

INCREASING PRODUCTION BY RAISING TAILS ASSAY

Dr. **Seaborg**. That is right. There would still be a means of increasing production, somewhat uneconomic. That would be to increase the tails assay still further and get your production back up to where it was at greater cost.

But that would be to an uneconomic level.

Representative **Hosmer**. What some of us are worried about, Dr. Seaborg, is the great "uneconomics" of incurring a nuclear fuel gap at some point along the way. Now maybe the Russians would sell us some enriched uranium; I don't know.

Representative **Holifield**. Well we could negotiate with them.

Representative **Anderson**. This is the age of negotiations.

Dr. **Seaborg**. It will be several years before we are operating at the full capacity of all three plants.

Representative **Holifield**. It will also be several years before you get the CIP or an additional enrichment plant.

Dr. **Seaborg**. Yes. I only put that in the context that we could transfer power as long as the other two plants, the ones that hadn't suffered this disaster, were not at full capacity.

Representative **Holifield**. I said that a minute ago. All the plants should be operating at full capacity in the 1970's. From that time on more production would not be available. You could not use transferred power because the plant would be operating at full capacity.

Representative **Hosmer**. The later the date you pick for this interruption scenario, the more critical it becomes.

Mr. **Seaborg**. That is right.

Representative **Holifield**. The more necessary the CIP becomes and the more necessary it is to start CIP soon to overcome that 4- or 5-year lag time for the insertion of the new barriers and to increase the existing plant by the 40 percent additional capacity.

Dr. **Seaborg**. We will give you an analysis of this.

(The statement referred to follows:)

EFFECT OF A 6-MONTH SHUTDOWN OF A GASEOUS DIFFUSION PLANT BEGINNING JULY 1, 1971

In the event of an outage of any of the three diffusion plants, efforts would be directed to minimizing the effect of the outage on production of material required for Government and civilian purposes. Subject to the availability of adequate transmission facilities, efforts would be made to utilize at the two cascades remaining in operation all of the electric power scheduled for delivery to the three-plant complex. The adequacy of transmission facilities would, of course, be affected by conditions existing at the time and would involve detailed studies by the utility systems involved. In the absence of specific studies by such utilities for the situation under consideration, it has been estimated by AEC staff that power scheduled for use during the next six-month period, either at Portsmouth (700 MW) or Oak Ridge (500 MW), could probably be transferred for use at the two plants remaining in operation if either Portsmouth or Oak Ridge were incapacitated. On the other hand, it has been estimated that only 1000 MW of the 1500 MW of power scheduled for use at Paducah could be effectively transferred to the other two plants.

Under those assumptions, shutdown of either the Oak Ridge or Portsmouth plants would result in only a small loss of separative work production while an outage of the Paducah plant has been estimated to result in an approximate 20 percent reduction in the separative work output scheduled for the six-month period beginning July 1, 1971.

While total separative work production would not be significantly reduced in the event of an outage of the Portsmouth plant, such outage would result in a loss of capability to withdraw highly enriched uranium during the period of the outage. There are continuing requirements for such high assay material. The Oak Ridge top could not be reactivated for effective production during this period. Thus, deliveries of highly enriched uranium could, in this instance, fall short of scheduled requirements until the Portsmouth plant had been returned to service and production of high assay product catches up with demand.

The bulk of current requirements and current production is low enriched uranium and the availability of such material for delivery to users would not be significantly affected by shutdown of either the Portsmouth or Oak Ridge plants. However, since loss of the Paducah plant would result in about a 20 percent reduction in separative work output, the total availability of low enriched product would be reduced. If it were deemed desirable to minimize such reduction, steps could be taken to increase the cascade feed and tails assay. For example, an increase in tails assay from 0.3 percent to 0.4 percent would limit the loss in production of low enriched uranium to about 2 percent of that scheduled during the last six months of 1971.

Dr. SEABORG. Now I will go on with reactor development.

Representative HOSMER. I apologize if we have taken you off course.

Chairman PASTORE. We travel this way many times.

Dr. SEABORG. I will try to remember where we were.

REACTOR DEVELOPMENT

An increased authorization of $4 million in operating costs and related GSO is needed to augment water reactor safety programs and our work on high-level waste handling and disposal.

As you may be aware, these matters are being increasingly accentuated in public debates and official hearings. We would be concerned if any of these matters introduced delays in AEC independent safety evaluations, leading to delays in licensing and plant operations with attendant adverse implications for nuclear power and the critical supply of electric power in many regions with only marginal electrical reserves. Accordingly, we believe that we should take this opportunity to obtain increased funding for timely advancement in the nuclear safety area.

Representative **Price**. Mr. Holifield.

Representative **Holifield**. We had some testimony here from Dr. Seaborg, and I will read to you:

> As a result of increases in the cost of producing separative work, particularly the electric power cost element, it is apparent that tails assay at which diffusion plants are operated should be increased. While the specific magnitude of the increase in tails assay has not yet been decided it has been concluded by AEC and OMB that, with an increase in tails assay, it will not be necessary to make the major commitment for CIP-CUP during fiscal year 1972.[1]

This is the kind of thing that bothers some of us, because we can see within this operation a considerable political motivation. I recognize that you have certain figures that you have from the computers but the assumptions that are put into computers, as you know, determine the output. There is an old saying, "Garbage in—garbage out," when we are talking about software and computers.

So, I cannot help but believe that the real motivation for this was to prevent the utilization of the money that Congress has appropriated for the purpose of getting started on the CIP.

Mr. **Flaherty**. Mr. Holifield, what motivations are all over town I cannot speak to, but I can state to you very sincerely, very honestly, that if we were going ahead today full blast on CIP, that we would still be raising the tails assay in the plants because of the increases that we have had in the cost of electricity. Now that is a true and honest statement.

Representative **Price**. The increases you have already had?

Mr. **Flaherty**. Yes, the increases we have already had, plus the fact that we are at this time, since we have undershot in the past, trying to provide some contingency at no penalty to the enterprise so that we won't get caught by having set it too low again.

Representative **Holifield**. That might be credible if you were setting this price for a period of time. But you can come in within 90 days or 120 days with another increase just like you did before when you went from $26 to $28.70, and then to $32.

OPERATE AT 0.30 PERCENT TAILS ASSAY FOR 2 YEARS

Mr. **Flaherty**. Mr. Holifield, of course things can change, but it is our plan to operate these plants at this 0.3 tails assay for a period of 2 years, giving us an opportunity to sit down and see what it properly should be and arrive at a decision on, we hope, a longer term solution to the problem.

Representative **Price**. Do you have any idea what you think it might be 2 years from now?

Mr. **Flaherty**. Yes, sir; we are saying that 0.25 is a likely number 2 years from now.

To answer the question that you asked before, which I didn't answer, the tails assay that we would assume as an appropriate one today is also about 0.25, slightly less than that.

Representative **Hosmer**. That is 2 years. How about 4 years from now?

Mr. **Flaherty**. I certainly don't have, I wouldn't want to make an estimate for 4 years from now.

Representative **Hosmer**. Then you would not be able to tell us whether this tails assay and even this price for separative work would be good for more than 2 years, is that right?

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[1] Testimony of Dr. Seaborg before the Joint Committee on Mar. 18, 1971. (See p. 2341.)

Mr. **Flaherty**. I think when we were here before testifying on the price I said that we had a hope it will be good.

Representative **Hosmer**. You have a what?

Mr. **Flaherty**. A hope. I think I would have to answer the question the same way.

Representative **Hosmer**. An anti-inflationary hope?

Mr. **Flaherty**. Yes, sir.

Representative **Hosmer**. You are just crystal-balling, aren't you?

Mr. **Flaherty**. Indeed we are.

Representative **Hosmer**. Thank you.

IMPACT OF TAILS ASSAY CHANGE ON TIMING OF CIP

Representative **Price**. Mr. Flaherty, what impact has the tails assay had on the CIP decision? Has it delayed it in any way?

Mr. **Flaherty**. Certainly not, to my knowledge, Mr. Price.

Representative **Price**. Could it delay it for any period?

Mr. **Flaherty**. I think the only thing that we have seen, the effect of this in the long range scene, has been that the date on which we would need a new plant after CIP has been accomplished is deferred by something like 3 to 6 months. But there has been no planning in this connection that would change the schedule of CIP–CUP.

COST OF OPERATING AT 0.25 TAILS ASSAY

Representative **Price**. What is the fiscal year 1972 cost of increasing the operating tails assay to 0.25 percent?

Mr. **Flaherty**. It would be approximately half the amount we are asking for to go to 0.3.

Representative **Price**. Your computer calculations call for an increase up to about 25 percent. As a matter of fact, you said this is what it is right now.

Mr. **Flaherty**. Yes, sir.

Representative **Price**. What is the basis for setting that at 0.05 percent higher?

Mr. **Flaherty**. The basis is that we wish to provide ourselves with this contingency that I mentioned. We have not factored into this computer case any estimate for increasing power costs. On the basis that power costs may increase further, even though we hope they won't, we are providing ourselves with a contingency.

WHO BEARS COST OF OVERSTRIPPING URANIUM

Representative **Price**. Now you said in your statement that "If we overstrip our feed stocks we never can get back the electricity and other costs that went into the process."

Does that mean to indicate that the Government suffers a monetary loss?

Mr. **Flaherty**. I think that I answered that by saying that the monetary loss would be suffered by the industry. We, of course, will continue to price to recover the Government's cost. So, the ultimate bearer of the burden will be the customers for the enrichment service.

Representative **Price**. The customer will pay the cost?

Mr. **Flaherty**. Yes, sir.

Representative **Holifield**. Would you say the customers are losing one-fifth of the recovered value of the enriched material by your going from 0.2 to 0.3 in recovery?

Mr. Flaherty. No, sir; I would not say that.

Representative Holifield. Why would you not say that?

Mr. Flaherty. Because the customers, Mr. Holifield, for this period of time we are talking about will be dealing with us on the basis of 0.2 tails associated with existing preproduced material. Now future customers will receive present production. We plan to take the higher tails associated with that production and refeed them to the plant—in the future and strip them down to whatever the optimum is at that time. So that there would be no loss of value anywhere along the line.

Representative Holifield. Would you set up a credit for the tails of customers?

Mr. Abbadessa. That decision has not yet been made, Mr. Holifield. It is my present judgment that if we go to 0.3 tails and we have an operating plan that says in 2 years we plan to go to 0.25, then I think we probably will assign a value to the tails retained. We can assign a value, and I think we probably should.

Representative Holifield. I was wondering because, as I understand it, they have the option to take it if they want to.

Mr. Abbadessa. That is correct; however, since we are not changing our pricing schedule, the customer is not affected.

Representative Holifield. Of course, they don't have any way of taking care of it and why they should take it, I don't know. But if they don't take it, then you have the problem of storing it and keeping it and maintaining whatever inventory costs accrue to it at that point.

So it seems that there have been a number of answers that we have not figured that in, we have not reached a conclusion, and so forth, but I would say there are probably a lot of questions which even we do not know that might come up on this matter.

Let me ask you a question, Mr. Flaherty. A few minutes ago, you mentioned 3 to 6 months' time which in your opinion should be attributable to the delay in starting the CIP.

DEFERRAL OF DATE FOR NEW PLANT CONSTRUCTION

Mr. Flaherty. No, sir; I meant to say that the time when we need a new plant, which is some time in the 1981 period, could be deferred for as much as 3 to 6 months. I said further that there was nothing, that I could trace in this change which would affect the schedule for CIP–CUP.

Representative Holifield. In your computations you fed certain assumptions into the computer, no doubt.

Mr. Flaherty. The assumption here is that we are authorized to go ahead with CIP in fiscal 1973. I believe further we are assuming that the $16.1 million is released to us for use next year. The assumption we are making here is that the $16.1 million which, as you know, is being held in reserve, will be made available to us for use this next year and there will be full authorization——

Representative Holifield. In other words, when you come up before us next time for budget consideration you expect that that will be considered?

Mr. Flaherty. That is certainly our planning, yes, sir.

Representative Hosmer. Refine this just a little bit more. Senator Pastore during the morning was talking about actually marking up this authorization next Wednesday. I was wondering if Dr. Larson might have some information that this $16 million will be released by then so that we can go ahead with ease and confidence in marking up the bill.

Dr. **Larson**. I don't have any specific information on that particular point at this time.

Representative **Hosmer**. Without being accused of blackmail, could you check on it for us?

Mr. **Abbadessa**. You understand, Mr. Hosmer, the Commission has requested the $16.1 million from the OMB and they have it right now.

Representative **Hosmer**. Mr. Abbadessa, there ain't nobody here but us chickens, the foxes are downtown.

Representative **Price**. Mr. Holifield, do you have any further questions?

Representative **Holifield**. No.

Representative **Price**. Mr. Hosmer?

Representative **Hosmer**. Yes.

DISPOSAL OF URANIUM STOCKPILE

If and when the tails assay is increased to a higher level, say this 0.25 percent, the customer will need more uranium feed to obtain the same amount of enriched uranium. At that time, is it the intention of the AEC to require that some percentage of the increase be obtained out of the surplus?

Mr. **Flaherty**. We do not have such a plan, Mr. Hosmer. The plan would be that the increased feed requirements resulting from the increase to 0.25 percent in the toll enriching assay would be supplied by the private uranium market.

Representative **Hosmer**. Do you have some other plans, then, for the stockpile?

Mr. **Flaherty**. Well, we are developing plans for the disposal of the stockpile, yes, sir. They are not involved in this particular——

Representative **Hosmer**. Have you made mention of this to the committee?

Mr. **Flaherty**. We have not been in a position to come to the committee with a plan, no, sir.

Representative **Hosmer**. All of the utility people can rest easy and all the raw material people can rest happy that their raw material picture is going to be blessed, not interfered with by any permanent change in the tails assay?

Mr. **Flaherty**. Let me say that for the next 2 years, certainly, the period of which we are talking about, there is no effect whatever on the uranium market.

Representative **Hosmer**. But there could be in 1973, you say, when——

Mr. **Flaherty**. Of course there could be, Mr. Hosmer.

Representative **Hosmer**. How does this proposal to raise tails assay provide insurance against faster than anticipated growth in nuclear power, other than the 3 to 6 months?

Mr. **Flaherty**. I mentioned it is equivalent to supplying about twenty-five 1,000-megawatt plants for a period of 1 year.

EXHIBIT C

AEC
UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

VOLUME 2, NUMBER 42 WEEK ENDING OCTOBER 20, 1971

KERR-McGEE
CORPORATION

NEWS RELEASES

FOR IMMEDIATE RELEASE

No. 0-178
Contact: Robert Newlin
Tel. 973-3335
973-5371 (Copies)

AEC SEEKS PUBLIC COMMENT ON PROPOSED URANIUM SUPPLY POLICIES

The Atomic Energy Commission is requesting public comment on plans for disposal of AEC's surplus uranium stocks beginning in 1974 and for deferring until the latter part of this decade any general relaxation of the restriction on the enrichment of foreign uranium for use in domestic reactors.

The restriction on enrichment of foreign uranium was established by the Commission as a part of its Uranium Enrichment Services Criteria, in accordance with the provisions of the Atomic Energy Act, to help assure the maintenance of a viable domestic uranium industry.

The Commission proposes to take no action toward lifting this restriction until the mining and milling industry is in a stronger growth position, which the Commission believes will be toward the end of this decade. However, the Commission now considers it appropriate to reach decisions and begin action toward disposal of the AEC's surplus uranium.

Disposal of Surplus Uranium

After making provision for future government requirements, which are subject to some uncertainties, the AEC expects to have a surplus of natural uranium (equivalent to about 50,000 tons of U_3O_8) available for sale to domestic and foreign customers.

Under the Commission's plan for disposal of its surplus uranium, deliveries to the domestic market would begin in 1974. They would not exceed in any year one-half of the projected cumulative growth in domestic requirements from 1973 to and including that year, nor would they exceed one-fourth of the total domestic requirements in any such year. In the attached illustrative schedule, the maximum delivery in any one year is limited to 7500 tons U_3O_8.

In view of the substantial uranium inventories held by consumers in the short-term future, the quantity which would be offered for delivery in 1974 and 1975 would be less than the deliveries which might otherwise be made under this formula.

It is contemplated that in early 1972, offerings would be made for material to be delivered in 1974, 1975 and 1976. Bids would be requested on a dual basis -- payment at the time of delivery and prepayment at the time of the award. Bids could be accepted or rejected at the Commission's option.

Subsequent deliveries would be phased into the commercial market at an increasing rate related to the projected growth in domestic nuclear fuel requirements, but within the established maximum. AEC would begin to withdraw from the market gradually toward the end of the disposal period so that industry could increase its capacity to replace government sales in an orderly manner.

If there are major changes in the supply or requirements, or if experience indicates the formula requires modification, the AEC may revise the disposal plan. However, any changes will be consistent with maintaining the viability of the domestic uranium industry. Any significant proposed changes would be issued for public comment in advance of adoption.

Removal of Restriction on Foreign Uranium

The Commission stated September 7, 1968, that removal of the restriction on the enrichment of foreign uranium for domestic use might be possible by July 1, 1973, or earlier, and that it intended to announce the proposed date as early as possible. The Commission also said it would consider removing the restriction on a graduated schedule.

In recognition of uranium production plans already adopted, the expected soft uranium market over the next several years, the availability of large surplus domestic and foreign stocks, and the availability of excess foreign uranium production capability, the enrichment of foreign uranium for domestic reactors would be deferred until the latter part of the present decade. After that time, it is anticipated that an individual could furnish foreign uranium as part of the feed for enrichment transactions where the enriched product was intended for domestic use. The proportion of foreign feed initially would be limited, but it would be increased in subsequent years, depending on developments, until all restrictions had been removed.

The Commission will make periodic reviews to determine whether there is any need for change in the timing of the initial relaxation of the restriction, as well as to define the appropriate ratio of foreign to domestic uranium to be accommodated. The Commission expects that experience in the commercial market under partial removal of the restriction, together with trends in the growth of nuclear power, will permit decisions on the timing and extent of further relaxations of the restriction without compromising the viability of the United States uranium industry. Every effort will be made to announce specific steps sufficiently in advance to permit realistic planning by the industry.

The Commission will consider all comments which may be submitted on the plans for the surplus disposal program and on the continuing deferment of enrichment of foreign uranium for domestic use.

Suggestions should be sent in triplicate to the Office of the Secretary, U. S. Atomic Energy Commission, Washington, D. C. 20545, within 60 days of this announcement. After consideration of all comments, AEC's proposed plan on these matters will be published in the Federal Register with further opportunity provided for comment.

October 13, 1971

ILLUSTRATIVE SCHEDULE OF AEC SURPLUS URANIUM SALES

(Short Tons U_3O_8)

(1) Calendar Year	(2) [f] Deliveries by Industry Tons	(3) [b] Prospective Annual Deliveries By AEC	(4) [a] Total Projected Annual Requirements (2) + (3)	(5) [b] Cumulative Growth in Requirements Tons
1973	14,700		14,700	
1974	17,400	800[c]	18,200	3,500
1975	18,100	2,000[c]	20,100	5,400
1976	18,900	4,100	23,000	8,300
1977	20,700	5,900	26,600	11,900
1978	23,700	7,500[d]	31,200	16,500
1979	27,100	7,500[d]	34,600	19,900
1980	29,800	7,500[d]	37,300	22,600
1981	36,300	6,500[e]	42,800	28,100
1982	43,800	4,500[e]	48,300	33,600
1983	49,800	3,700[e]	53,500	38,800
1984	58,800		58,800	44,100

(a) Projected requirements taken from WASH-1139, January 1971, adjusted to a toll enrichment tails assay schedule of 0.20% to 7/1/73 and 0.25% thereafter. Projection subject to periodic updating to reflect new and revised information and schedules.

(b) AEC deliveries to domestic market in any year limited to one-half the cumulative annual growth in requirements beyond 1973, within a ceiling of one-fourth of the domestic requirement in such year.

(c) AEC deliveries below formula for 1974 and 1975 because of thin market.

(d) AEC deliveries in 1978-79-80 limited arbitrarily to 7500 tons.

(e) AEC deliveries limited to permit gradual phasing out of AEC deliveries.

(f) Does not make allowance for foreign imports which may begin toward the end of the decade.

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No. O-180 FOR IMMEDIATE RELEASE
Contact: Philip D. Keif
Tel. 973-3446
973-5371 (Copies)

NOTE TO EDITORS AND CORRESPONDENTS:

An Atomic Safety and Licensing Board will resume its prehearing conference October 19, 1971 in Washington, D.C. on application by Wisconsin Electric Power Company and Wisconsin-Michigan Power Company to operate Unit 2 of the Point Beach Nuclear Plant at Two Creeks, Wisconsin. (The first session was held last May at Manitowoc, Wisconsin.)

The conference is scheduled to begin at 9:30 a.m. in Room 115, Lafayette Building, 811 Vermont Avenue, Washington, D.C.

October 14, 1971

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No. O-181 FOR IMMEDIATE RELEASE
Contact: Clare Miles
Tel. 973-3446
973-5371 (Copies)

AEC CONSIDERS REGULATION AMENDMENTS RELATING TO RESEARCH REACTORS USED FOR COMMERCIAL PURPOSES

The Atomic Energy Commission is considering amend to its reactor licensing regulations to provide a basis determining, for licensing purposes, which research and development and training reactors will be considered as used for industrial and commercial purposes. The propose amendments are in further implementation of amendments to the Atomic Energy Act enacted last year.

The legislation enacted on December 19, 1970, comm referred to as "practical value legislation," requires t utilization and production facilities for commercial or industrial purposes must, with certain exceptions, be li under section 103 of the Atomic Energy Act as amended. cations for licenses under this section are subject to anti-trust provisions, to mandatory hearing requirements to requirements for review by the Advisory Committee on Safeguards.

The principal purpose of the legislation was to subj facilities such as nuclear power plants and fuel reproce plants to licensing under section 103. However, the legis tive history shows that Congress also meant to include reactors which are used substantially for commercial pur such as research reactors that are used to produce radioisotopes for sale or that are used for neutron radiograph a commercial basis.

The purpose of the proposed amendments is to define circumstances under which research and development and tr reactors will be considered to fit in the industrial or mercial category. These circumstances are that the facili be designed or used so that more than 50 percent of the cost of owning and operating the facility is devoted to the production of materials, products, or energy for sale or mercial distribution, or for the sale of services, other th research and development or education or training. Facili at nonprofit educational institutions which are used for training or education purposes only will continue to be licensed under section 104.

Some adjustments may be needed in the license fees payable by holders of licenses that presently fall within the research reactor category in Part 170, the Commission's regulation on license fees. Such adjustments and related changes will be considered by the Commission as part of its continuing consideration of license fees.

Notice of the proposed amendments to Part 50 will be published in the Federal Register on October 15, 1971. Interested persons may submit written comments or suggestions to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Chief, Public Proceedings Branch, within 60 days after that date.

October 14, 1971

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No. O-182 FOR IMMEDIATE RELEASE
Contact: James Lynam
Tel. 973-3335
973-5371 (Copies)

NOTE TO EDITORS AND CORRESPONDENTS:

Following is a brief status report on the U. S. civilian nuclear power program as of September 30, 1971:

During the first three quarters of this year, electric utilities made known plans for 24 nuclear power generating units with a total capacity of 24,360,000 kilowatts to be located at 14 power stations. Reactor suppliers were selected for 17 of these units and for one announced in 1967.

In the first three quarters of 1970, utilities made k plans for 13 nuclear power generating units with a total capacity of 13,407,000 kilowatts to be located at nine power stations. Reactor suppliers have been selected for these plants and for one announced in 1967.

EXHIBIT D

Excerpts from AEC Authorization Hearings before the JOINT COMMITTEE ON ATOMIC ENERGY

March 1972

ROLE OF PRIVATE INDUSTRY IN ENRICHMENT

Policy statements issued in the past by both the President and the Commission have expressed the view that private industry should in the future assume responsibility for providing uranium enrichment capacity and furnishing uranium enrichment services. The Commission believes that it is now timely to give our full encouragement to the private sector to proceed to develop plans and proposals to engage in providing commercial uranium enriching services by the construction and operation of the new enriching plants to be needed in the early 1980's, and beyond. As the committee has been informed, the Commission has already undertaken certain preliminary steps in this direction through the initiation of a program under which a number of U.S. companies are being provided access to AEC classified technology and will have the opportunity to undertake private research and development effort, with the view toward future investment in privately owned facilities for the manufacture of uranium enriching equipment and, subsequently, for the performance of uranium enriching services. This access program is currently in its initial phase; we believe that our encouragement of the private sector to develop plans and proposals to supply uranium enriching services on a private commercial basis will provide more definitive objectives for the ongoing access program.

We are currently witnessing, in many countries of the world, efforts directed toward the development of a commercial uranium enriching business and we believe that the normal commercial incentives of our domestic private industry will enhance the competitive position of this country in this world market with economic benefits both to the United States as producer and to our customers abroad. Any such private activities will, of course, necessarily be conducted under the Commission's security procedures to assure that classified technology is adequately protected.

In his June 4, 1971, energy message, to which you have adverted, Mr. Chairman, the President expressed the view that while private enterprise was expected to assume the responsibility for uranium enrichment in the future, the Government must in the meantime take appropriate steps to assure that enrichment capacity in this country is expanded at a rate consistent with expected demands. The Commission fully supports this policy and is implementing it not only by encouraging the private sector to engage in uranium enriching on a commercial basis, but also by including in our long-range planning contingency options for increasing capacity at our existing facilities if this should prove necessary. Recognizing the need for such contingency plans, we will assure that they are available on a timely basis.

DISPOSAL OF SURPLUS URANIUM STOCKS

On October 13, 1971, the Commission announced for comment a proposed plan for disposal on the commercial market of 50,000 tons U_3O_8, projected to be surplus to future Government needs. This plan contemplated annual offerings of quantities of uranium for competitive bids. Comments from industry on the proposed plan, primaril the uranium producing industry, expressed the view that disposal of Government stocks should be deferred until a later date and a number of companies suggested indefinite retention of such stocks as a reserve for use in overcoming contingent shortages in the future. Concern was also expressed that entry of the Government into the uranium market could serve to discourage private investment in exploration and development of the new uranium reserves and production capability which will be needed to meet requirements in the 1980's and beyond. The Commission has always recognized the importance to this country of a healthy domestic uranium producing industry and in formulating our policies, we intend to continue to assist toward this goal. The Commission also believes that the large investment made by the taxpayers of this country in these uranium stocks cannot justifiably be frozen indefinitely. We further recognize that the magnitude of the AEC suprlus stocks will become less significant as a reserve in the future as consumption rates increase rapidly through the 1980's. What we believe is most important, however, is that the private uranium producing industry know with some degree of assurance the intentions of the Government with respect to disposal in order that private planning and investment decisions can be made on an informed basis. We believe, therefore, that we should proceed with a plan under which the existing surplus stocks will be reduced gradually over a period of time.

We have considered a number of alternative ways in which the available surplus stocks of uranium feed material can be used in conjunction with our operations for uranium enrichment and preproduction, ways which would be attractive in meeting both Government and industry objectives. After considering such alternatives, we have concluded that the most appropriate course of action is to operate the diffusion plants at a somewhat higher tails assay than previously planned, while continuing to employ the existing schedule for our uranium enrichment services transactions. This schedule, as you know, is based on a transaction tails assay of 0.20 percent. Operation in this manner will gradually reduce our stocks of surplus uranium and in a way which will avoid direct competition by the Government in the private uranium market. Our studies indicate that proceeding in this manner would not, in itself, affect the charge for our toll enrichment services, yet it would provide a reasonable return to the Government for its surplus uranium. Operation of the enriching plants at a tails assay slightly higher than that previously planned also permits the existing plants to meet requirements until a later date, with the associated benefits already described.

A further matter related to the one of disposal of surplus uranium stocks is the schedule on which the Commission will relax and ultimately remove the existing restriction on enrichment of foreign uranium for domestic use. On this matter the Commission retains the view expressed in our October 13 announcement that consistent with a plan for disposal of surplus uranium stocks, such relaxation should be deferred until late in the decade, probably 1978, and we plan to reach a decision on the initial relaxation within the next 2 years. Such decision would, of course, involve a modification to our uranium enrichment services criteria which would be reviewed by the committee at that time.

ENRICHMENT PLANT OPERATIONS

We have periodically furnished to the committee, pursuant to its request updated projections of supply of uranium services from our existing facilities and the expected demand on such facilities by domestic and foreign customers, and making provision for Government and other miscellaneous requirements. I am pleased to supply herewith our current updating of such plan on the basis of policy decisions which I have been reviewing with you. The following tables present an annual comparison of supply and demand, including the annual level of the preproduction inventory and indicating the point in time when new enriching plants are projected to be needed.

(Tables I and II follow:)

TABLE I.—PROJECTED DIFFUSION PLANTPOWER LEVELS AND SEPARATIVE WORK AVAILABILITY VERSUS SEPARATIVE WORK REQUIREMENTS

[Separative work in thousands of kilogram-units]

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Diffusion plant operations:														
Operating tails assay—Percent U^{235}	0.30	0.30	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275	0.275
Average 3-site power level (megawatts)	2,526	2,740	4,085	4,558	5,008	5,436	5,644	5,185	6,980	7,380	7,380	7,380	7,380	7,380
Annual separative work production	8,400	8,700	12,300	14,400	16,300	18,200	19,900	22,300	26,100	27,900	27,900	27,900	27,900	27,900
Included separative work:														
From CIP					900	1,900	3,200	4,400	5,300	5,700	5,750	5,750	5,750	5,750
From CUP								100	3,300	4,750	4,750	4,750	4,750	4,750
Separative work supply and demand (0.275 percent tails assay):														
Effective annual increment in separative work availability due to evaluation at 0.275 percent tails assay	500	500												
Cumulative separative work available including the July 1, 1971, inventory of 10,500 thousands of units	19,400	28,600	41,500	55,900	72,200	90,400	110,300	132,500	158,700	186,600	214,500	242,400	270,300	298,200
Annual separative work requirements [1]	4,300	5,900	6,400	9,700	14,300	16,500	20,900	27,300	31,500	34,500	[2] 44,900	[2] 41,700	[2] 47,100	[2] 49,600
Cumulative separative work requirements	4,300	10,200	16,600	26,300	40,500	57,200	78,300	105,300	136,500	171,000	215,900	257,500	304,900	354,500
Separative work in preproduction inventories	15,100	18,400	24,900	29,500	31,500	33,200	32,300	27,500	22,200	15,600				
Separative work requirements from new plant:														
Annual											1,400	13,800	19,400	21,700
Cumulative											1,400	15,200	34,500	56,300

[1] Covers projected domestic and foreign civilian power demand, Government, and other miscellaneous uses.

[2] Separative work requirements include a flywheel equivalent to ¼th of the next years requirements.

Nantasket Beach, Mass. (See Beach erosion studies.)

TABLE II.—SUMMARY OF PROJECTED NET SEPARATIVE WORK REQUIREMENTS COMMITTED AND ANTICIPATED

[Separative work in thousands of kilogram units 0.275 percent tails assay basis]

Fiscal year	Central station power[1]								Government and other nonpower applications	Total separative work requirements, annual
	Domestic				Foreign					
	Under allocation and/or contract	For stations which have been ordered[2]	Anticipated	Total	Under agreements for cooperation (including contracts)	Anticipated	Total	Total		
1972	3,600	3,600	....	3,600	1,000	....	1,000	4,600	(300)	4,300
1973	4,200	4,400	....	4,400	1,400	....	1,400	5,800	100	5,900
1974	4,300	4,600	....	4,600	1,500	....	1,500	6,100	300	6,400
1975	5,200	7,200	....	7,200	3,200	200	3,400	10,600	(900)	9,700
1976	5,200	9,500	400	9,900	2,600	1,600	4,200	14,100	200	14,300
1977	4,300	10,400	....	10,400	3,900	2,100	6,000	16,400	200	16,500
1978	4,300	10,500	1,600	12,100	3,170	4,700	7,900	19,900	300	20,300
1979	3,800	8,200	6,800	15,000	3,370	6,500	9,900	24,900	2,100	27,000
1980	3,500	8,500	9,300	16,900	3,500	8,100	11,600	28,400	3,100	31,500
1981	3,200	8,000	11,300	19,300	3,530	8,800	12,300	32,200	2,300	34,500
1982	3,100	8,000	14,200	22,200	3,570	9,700	13,300	35,500	2,100	37,600
1983	2,900	7,900	17,300	24,300	3,620	10,700	14,300	38,600	1,700	40,300
1984	2,700	7,900	20,500	28,400	3,530	12,200	15,800	44,200	2,200	46,400
1985	3,000	7,900	24,000	31,900	3,470	11,800	15,300	46,900	2,300	49,200
Total	53,300	105,300	105,400	210,700	41,300	75,500	117,900	328,500	16,300	345,400
1986 through 2002	61,700				59,300					

[1] Requirements based on "most likely" forecast of nuclear power growth.

[2] Includes separative work under allocation and or contract.

Dr. **Schlesinger**. The table includes the schedule of use of electric power in the existant three enriching plants and shows separately the contributions of the cascade improvement program (CIP) and cascade uprating program (CUP) as these are scheduled under our current plan. The plan for utilization of electric power and for proceeding with the cascade improvement program is consistent with our fiscal year 1973 budget request. This table is presented on the basis of our planned minimum operating tails assay of 0.275 percent after fiscal year 1973, although we are studying the desirability of continuing to operate at the current 0.30-percent level. I have mentioned earlier the several advantages of higher operating tails assay. At the 0.30-percent level, the existing plants would be able to meet projected requirements through fiscal year 1982, whereas at the 0.275-percent level the date would be about 9 months earlier.

The operating schedules for the enrichment plants call for new commitments to be made for electric power supply during the current calendar year. We are proceeding with the contractual arrangements associated with such commitments, which arrangements, after they are firmed up, will be reported as usual to the committee. The plan contemplates further decisions in future years for additional quantities of electric power, as well as the construction decisions associated with proceeding with the CIP and CUP. We intend to keep our plans for plant operations, for toll enriching and for conducting the CIP and CUP under continuing review to assure that any appropriate updating modifications are made in a timely manner. Because of the many factors involved in programing these operations, many of which involve uncertainties, periodic updating of the plan should be expected. In this connection, we are reviewing the terms and conditions of our enriching services contracts with the objective of reducing certain of the uncertainities in future demand. Nevertheless, at any point in time, on the basis of then-current projections, the plan would represent the program the Commission is prepared to implement.

In summary, the policy positions we have adopted and the operational schedules which we have programed accomplish the following:

1. Provide a planning basis for power restoration, for cascade improvement and for cascade uprating in the existing enrichment plants.
2. Permit the existing plants, with improvement and uprating, to meet projected requirements until fiscal year 1982.
3. Provide the requisite assurance that enriching capacity can be expanded as necessary to assure utilities in this country that they will continue to have the option of selecting nuclear power to meet their generating requirements and to keep the United States in a position to continue to supply foreign customers with their needs for enrichment services.
4. Provide a basis upon which the private sector may proceed to plan its participation in providing uranium enrichment services.
5. Disposal of surplus AEC stocks without direct Government entry into the commercial market.
6. Provide for continued supply of uranium enrichment services on the same basis as is currently in effect.
7. Provide a long-term planning basis for the uranium producing industry with respect to exploration, development of reserves and installation of production capability

Mr. Chairman, this completes my prepared statement on these subjects. With fellow Commissioners and the AEC staff, I will be happy to address any of the details of this program as the committee may desire.

Chairman **Pastore**. Now this program that you mentioned, Dr Schlesinger, does this fit within the budget estimates that are before the committee?

Dr. **Schlesinger**. Yes, sir.

Chairman **Pastore**. As I recall, wasn't there a deletion of money for electricity?

Dr. **Schlesinger**. That deletion is reflected, Mr. Chairman, in the presentation before you in table I. If you look at the separative work production for fiscal year 1973, the number is 8,700 metric tons. Without the deletion it would have been a higher number, 11,300 metric tons of separative work. But this is the plan that you have before you and it is consistent with our budget estimates, Mr. Chairman

COMPREHENSIVE PLAN

Mr. Chairman, if I might take one moment more, I would like to put on the screen an overall summary chart, figure 1.

(Chart shown follows:)

Figure 1

OVERALL SUMMARY

Comprehensive Plan, Optimizing for Multiple Objectives, Providing Solution Which Appropriately Balances Interests of Relevant Parties

- INCREASE PRODUCTION OF ENRICHED MATERIAL
  - GREATER ASSURANCE OF SUPPLY, AND OF MARKET, FOR DOMESTIC AND FOREIGN UTILITIES
- CONTROL NET BUDGET OUTLAYS AND DISPOSE OF STOCKPILE
- ENHANCE SALES OF URANIUM PRODUCERS VICE OCT. 13 OUTLINE
  - NO DIRECT GOVERNMENT SALES THAT MIGHT DISRUPT MARKET
- SUPPLY FOREIGN MARKET AND PROVIDE BUTTRESSING OF BALANCE OF PAYMENTS
- DEFER DATE OF NEW FACILITY TO 1982
  - POSTPONE OUTLAYS AND INVESTMENT
  - BETTER RESOLUTION OF TECHNICAL UNCERTAINTIES
- PROTECT OPPORTUNITY FOR PRIVATE ENTERPRISE PARTICIPATION

Dr. **Schlesinger**. Now, Mr. Chairman, the Joint Committee, in its work on authorizing the fiscal year 1972 budget, requested the Commission to come up with a comprehensive policy. We believe that this is fully responsive to the Joint Committee's request.

We have provided here a comprehensive plan which optimizes for multiple objectives, which provides a solution which appropriately balances the interests of all the relevant parties—the purchasers, the taxpayers, the uranium producers, the electric power industry, foreign purchasers, and the potential private investors.

This program has to be looked at in its entirety, Mr. Chairman. If it is looked at in terms of any one element there can be difficulties discerned with those individual elements. But in its totality it provides, I think, a reasonable solution to all of the concerns that have have been a matter of worry to the Joint Committee and to ourselves.

SHARING ENRICHMENT TECHNOLOGY

Chairman Pastore. But you will admit that we do have some uncertainties, if not imponderables. For instance, for some time we have been talking, that is, a representative of the State Department together with Mr. Johnson of the Commission, have been talking to us about this exchange of technology with some of our foreign friends for them to do their own enrichment. Where does that stand now? Is that as much in a state of flux now as it was a year ago?

Secondly, you say you have been talking with the private sector in a cooperative effort. If you consider this as one complete ball of wax, as one program without dismembering any one feature of it, don't these two imponderables become quite important in determining whether or not we do have an overall effective policy?

Dr Schlesinger. The advantages of this plan, Mr. Chairman, are not only that it meets a number of discrete problems that we face, including provision of additional enriched material and disposal of surplus Government stocks, but that it is gaged to deal with the kind of uncertainties that you mentioned. In the event that foreign producers do develop enrichment capacity overseas, our plan could be adjusted to meet the presumably lower production requirements which would result from that.

Our position with respect to foreign enrichment continues to be that the United States or U.S. industry would be delighted to continue to supply foreign utilities with their required enrichment services, that this is beneficial to us in terms of the balance of payments, that it is beneficial to foreign users because of the lower cost at which they can get the product. However, a number of countries have been concerned with exclusive dependence on the United States. We can understand that concern although we regard it as superfluous.

If in fact they wish to establish their own enrichment capacity, U.S. gaseous diffusion technology is available to assist them. But we are not pushing it on other countries. We are responsive and will be warmly responsive to their suggestions. If they request an increased portion of our capacity, our plan can be adjusted.

Chairman Pastore. What if they don't?

ADEQUATE CAPACITY UNTIL 1982

Dr. Schlesinger. The plan you have before you, Mr. Chairman, figure 2, provides for adequate capacity up until 1982.

(Chart under discussion follows:)

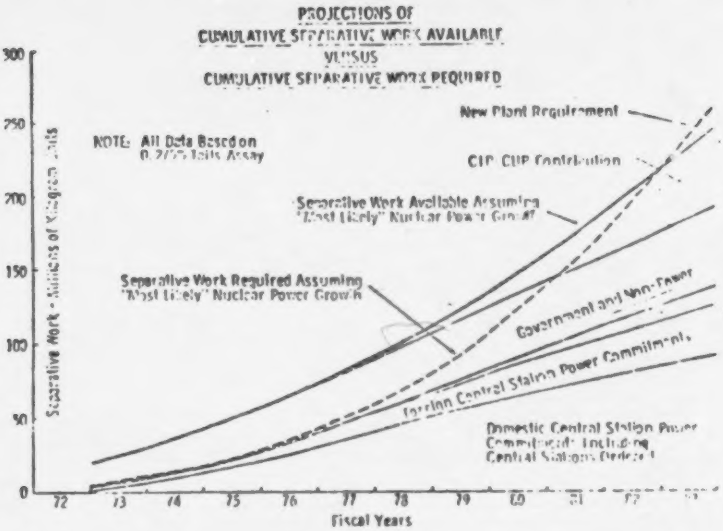

FIGURE 2

Dr. SCHLESINGER. The plan that you have before you, Mr. Chairman, permits us to assure to U.S. industry, which has been of fundamental concern to this committee, all of the enriched material that they will require for their fuel up to 1982, and at the same time will permit us to supply the foreign demand that we presently perceive up to 1982 with the associated balance-of-payments implications.

We have achieved this, Mr. Chairman, by a major commitment by the administration to increasing power to full capacity, and by the commitment to CIP and CUP.

Now your question goes to the point about what after 1982.

Chairman PASTORE. That is correct.

Dr. SCHLESINGER. There are two options, Mr. Chairman. We have indicated that we are preparing plans right now for add-on capacity at the existing gaseous diffusion plants. This would involve power commitments about 6 years in advance of 1982, and the construction of that capacity which would require a lesser period of time. Consequently, if private enterprise does not step forward, the administration would assume that in the fiscal year 1976 budget plans for the further expansion of capacity would be presented to the Joint Committee. It is the hope of the administration that private enterprise will see the advantages of coming into this program and if private enterprise does come in, then this would eliminate the necessity of the Government adding additional capacity. But what we have is a plan which increases markedly the availability of enriched material above the present production capacity of the plants.

Chairman PASTORE. Now if the private sector agrees to come in, say, by 1976, which would be the bicentennial of this great Republic, does that require expansion of our present plants, or would these be new plants?

Dr. Schlesinger. These would be new plants. Mr. Chairman.

Chairman Pastore. There is a vote going on now.

Mr. Price will take over, if he will.

Representative Hosmer. Will the chairman yield.

Representative Price (presiding). Yes.

LEAD TIME FOR NEW CAPACITY

Representative Hosmer. As I understand it, if private enterprise does not get itself together or even perhaps a foreign group with whom we had an agreement of some sort, that 1982 is the magic date and 6 years in advance of that we have to plan to expand our present diffusion complex?

Dr. Schlesinger. Yes, sir.

LEAD TIME FOR NEW PLANTS

Representative Hosmer. Now we have generally been taking a longer period of advance time, leadtime, in our contemplation of power supplies than we must have in the completion of a diffusion plant or a diffusion plant addition. Is that disparity no longer existent?

Dr. Schlesinger. I think the leadtime on providing additional power is about 6 years.

Representative Hosmer. What does TVA say about that?

Dr. Schlesinger. With regard to providing additional power?

Representative Hosmer. Yes.

Dr. Schlesinger. We are in conversation with TVA in regard to increasing power at the cascades as they prospectively will exist. We have not to my knowledge discussed providing power for add on capacity at the three plants.

Representative Hosmer. Generally, industry has been telling us, with all the aches and pains of getting anything on the line any more, you had better think in terms of 8 years leadtime, not 6 years.

Dr. Schlesinger. The period of time for private industry would probably be longer than 6 years because of the necessity of acquiring capital, of consolidating plans and of selecting a site. The leadtime for a Government plant addition is shorter than for private enterprise, partly because of experience, partly because of the existence of sites to which we would add on.

Representative Hosmer. That is without any consideration of the possible difficulties in the authorization and the appropriation process, I gather?

Dr. Schlesinger. Mr. Hosmer, with representation by the Joint Committee, I am sure we would have no difficulties in that area.

CASCADE IMPROVEMENT PROGRAM

Representative Price. What is your present schedule on the installation of CIP?

Dr. Schlesinger. Mr. Chairman, Mr. Holifield wrote to us a few months ago expressing his concern about the uncertainties and the fear that we might grow complacent about providing enriched material

His concern was well taken. I think we have not grown complacent on that subject. But the point I would like to make is that some of these uncertainties fall in the positive direction.

(Chart shown, figure 3, follows:)

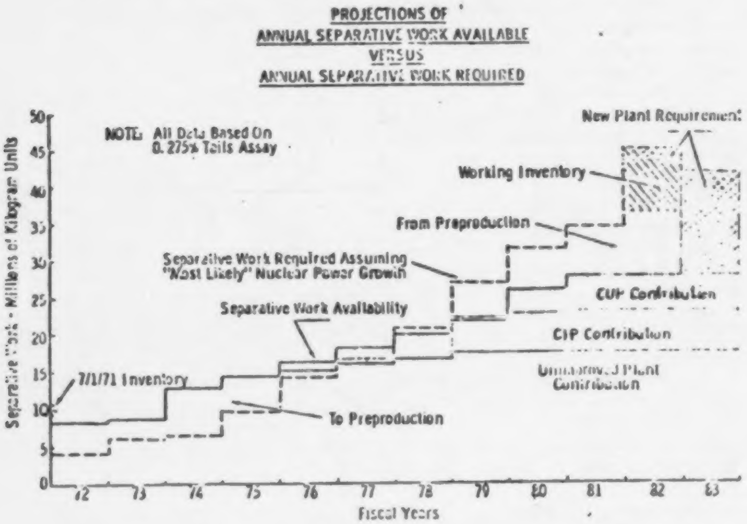

FIGURE 3

Dr. SCHLESINGER. In the case of the CIP, through further advances in technology we have been able to add 1,000 metric tons of capacity above that which was presented to the committee last year. So there will be a larger capacity increment associated with the CIP. That is one example of those uncertainties which tend to help us in a positive direction. The rate of installation of the CIP has been accelerated in an agreement with the Office of Management and Budget. I can run off the numbers for you if you should like.

Representative HOSMER. Is the number reflected in table I or not?

Dr. SCHLESINGER. The numbers are reflected in table I, but the numbers do not stand out clearly.

We have requested $120.3 million for the CIP for this year. We intend to obligate $20 million. The costs will run some $26 million. The total CIP runs $630 million.

Representative HOSMER. You slipped on the scheduled for getting the first units in operation, have you not, three-quarters from last year's estimated CIP completion date for the first 176 stages?

Dr. SCHLESINGER. The present schedule reflects prior year budgetary actions, and current plans. We could further accelerate it in the short term. I think the point we would like to make is that the present schedule will permit us to meet projected demands for enriched uranium from all quarters to 1982.

Representative HOSMER. Is this whole schedule optimized to the maximum cost effective point on expenditures, rate of expenditures, schedule of expenditures, receipts, cost of pre-production and all the other multitudinous factors that are going to make up this equation?

Dr. Schlesinger. We believe it is optimized. We may run some additional costs by going, if we can, beyond 0.275 tails assay with the desire of postponing the date for additional new capacity, thereby permitting resolution of technical uncertainties and the postponement of the outlays in the investment associated with that.

Representative Hosmer. You are buying yourself an insurance policy; is that it?

Dr. Schlesinger. We have bought ourselves considerable insurance. And this is a flexible plan, Mr. Hosmer. We are in a position to adapt that plan should it be necessary. There are a number of cushions which will protect us we believe, should, for example, demand expand somewhat more rapidly than we anticipate.

Representative Hosmer. On what cycle are you doing to remassage this whole problem?

Dr. Schlesinger. I think we are continually reviewing this as orders for new nuclear power plants come to the manufacturers. As we might see either a buildup of foreign demand or a buildup of domestic demand beyond that which is in the revision of WASH 1139, we would adjust the plan so as to insure that we have additional capacity.

Representative Hosmer. Does that mean you have a computer and you punch it out at 8 o'clock every morning and somebody puts it on your desk?

Dr. Schlesinger. If it were done that way we would not read it. What we would do is take a look at the change in the picture every 2 to 3 months.

Representative Hosmer. That is what I was trying to get at. You say you do it all the time. I know you don't do it all the time unless you do have a real time computer of some sort.

Dr. Schlesinger. We do it frequently enough to optimize between the investment of time and the acquisition of new information.

Representative Hosmer. That has always been a concern of the committee. I just don't want to be told that "Everything is all right, go out and run and play, boys." We want to know how often this is done and with what degree of thoroughness. I think you satisfied me with your eventual answer, but not with your first answer.

Dr. Schlesinger. We would not encourage the committee to run out and play, Mr. Hosmer, because I don't believe you would follow our advice.

SHARING TECHNOLOGY WITH FOREIGN GROUPS

Representative Price. Mr. Chairman, in last year's hearing, Commissioner Johnson in his prepared statement set 1 year as the time for negotiations for sharing technology with foreign friends. At the same time, Under Secretary of State Alexis Johnson indicated he thought it would take a minimum of 4 years to develop an agreed project before the implementation phase and construction began. Now, which estimate is being supported by experience?

Dr. Schlesinger. I think the two estimates were addressed to different criteria. I think I will let Bill Johnson speak to that. But I think before we have additional capacity planned by a multinational group it would be a matter of 3 or 4 years.

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Mr. Johnson. Mr. Chairman, I think the 3 or 4 years is right. If you want to look at the overall problem of not only doing the planning, but getting busy and raising the money, floating bonds, if they are underwritten, that sort of thing, by the time one gets an agreement within the United States and the other governments, and have the agreement signed on both sides it will be more than 1 year.

Representative Price. Three to four years.

Mr. Johnson. Is a more reasonable period.

Representative Price. Six to eight years to develop plans.

Mr. Johnson. Right.

Representative Price. That means 10 to 12 years.

Mr. Johnson. It would be about that for a foreign plant, on foreign soil.

Representative Price. Where are we now as to timing on the decision by foreigners to get up a firm proposal for a multinational plant using U.S. diffusion technology?

Dr. Schlesinger. We are in a poor position to answer that question, Mr. Chairman, because the consultations among the foreigners are such that we are not immediately privileged to them. We are hopeful that the Europeans will come to an agreement. On the other hand, we may be able to deal with the Japanese and other Pacific basin nations in regard to additional capacity. But let me reiterate that we are in the position that we are delighted to sell to other countries whatever amount of enriched material they need for their purposes. That is advantageous to them and it is advantageous to us. We are not pushing this project. We want to be responsive to their need.

INCREASE IN CIP COSTS

Representative Price. What is the reason for the $100 million increase from last year's CIP total estimated cost?

Dr. Schlesinger. I think one reason for the increase in CIP, Mr. Chairman, is the continued erosion of the purchasing power of the dollar; there has been a slow but steady escalation of costs and of cost estimates.

I don't think the components of the program have shifted markedly. The one exception is about $50 million for the 1,000 metric ton additional capacity I mentioned earlier which will provide a further expansion of our total capacity. Escalation is about $50 million.

Representative Price. What is your justification for requesting CIP authorization of over $120 million while only seeking obligational authority of $20 million?

Dr. Schlesinger. Mr. Chairman, the answer basically is that we are attempting to provide a request to the Congress which deals with a discrete package of work. This would involve 176 separation stages. This permits you to authorize this total package of work although the work will be implemented over a number of fiscal years.

Representative Price. Could you do what you plan to do if the Congress were to authorize only an additional $20 million instead of the $120 million requested?

Dr. Schlesinger. Mr. Chairman, I do not believe that we would want to go that far. I believe that we could obligate something on the order of $15 million.

Representative Price. Authorization?

Dr. Schlesinger. That would be obligational authority.

Representative PRICE. Did you want to say something on that, Mr. Abbadessa?

Mr. ABBADESSA. No, sir; Mr. Chairman. I think the chairman has the right answer.

Representative PRICE. Mr. Hosmer?

DISPOSAL OF AEC SURPLUS YELLOW CAKE

Representative HOSMER. Dr. Schlesinger, in this statement of yours it is implicit that yellow cake is in surplus supply. How was the decision arrived at, and by whom?

Dr. SCHLESINGER. The Commission estimates that 50,000 tons of yellow cake are surplus to our needs.

Representative HOSMER. Of the 55 or so?

Dr. SCHLESINGER. 50,000 tons.

Representative HOSMER. Of what total? 55 something?

Dr. SCHLESINGER. It is about 70,000 tons, and we are hedging against the possibility of additional need for military purposes. We are maintaining that hedge, and it is a prudent hedge. But it is plain, I think, that 50,000 tons would be destined either in the next decade or ultimately for burning by utilities' generating plants.

Representative HOSMER. So that you feel that you have an adequate cushion?

Dr. SCHLESINGER. Yes, sir.

Representative HOSMER. Against future contingencies?

Dr. SCHLESINGER. Yes, sir.

Representative HOSMER. And assuming that peace should break out, we have SALT and other disarmament agreements, and so on, would it be possible perhaps to even cut down that?

Dr. SCHLESINGER. Yes, sir. There is a further possibility of return of some of the oralloy from the Department of Defense.

As you know, some of our earlier weapons were prime oralloy users, and return from the Department of Defense would, for example, permit us to postpone for several months more the date that additional capacity would be needed.

SPLIT TAILS

Representative HOSMER. Im that connection, you have stated that on this 0.275 tails assay, if you ran it at something different, you could come in 9 months earllier. That is at 0.3 you need it in fiscal year 1982 and at 0.275 your requirement would come about 9 months earlier.

Dr. SCHLESINGER. Yes.

I think this chart, figure 4, will help explain what we are doing.

(Chart referred to follows:)

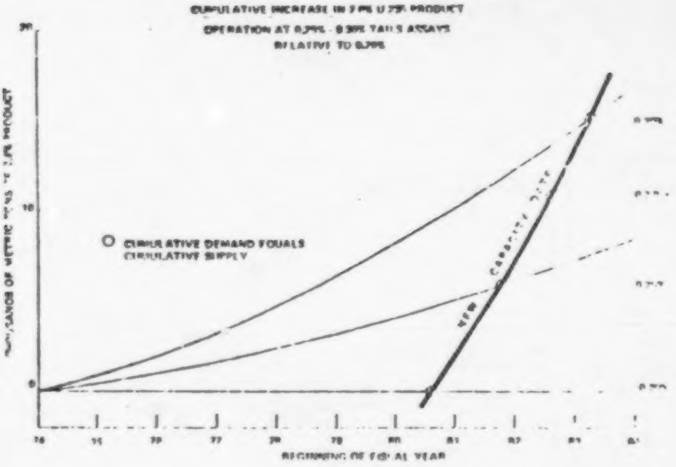

FIGURE 4

Representative HOSMER. What I am getting at, Dr. Schlesinger, if you went to 0.35 tails, would it bring it nine months later? Is there a linear relationship?

Dr. SCHLESINGER. No, sir. If you will look at the curve, you will see that the curve bends slightly in the upward direction, so it becomes more and more difficult over time to expand total capacity by raising the tails assay.

Now, what that curve does demonstrate, I think, is the advantage to the Government and to the industry of a higher operating tails assay. In the case of a 0.30 tails assay over the period of years that we are discussing, this will provide about 15,000 metric tons of product more than a 0.20 tails assay. That is equivalent to about 15,000 tons of separative work units. That is almost three times the annual capacity of our present plants, or almost double the capacity of the plants after CIP-CUP.

So that what we have is a scheme which simultaneously provides more enriched material, postpones the date for additional capacity, and at the same time disposes of the stockpile by trading feed for separative work.

Representative HOSMER. You are really trading feed for kilowatts, are you not?

Dr. SCHLESINGER. For separation work which includes kilowatts.

Representative HOSMER. You still have your tails, semidepleted tails, left. You can run them again some time later.

Dr. SCHLESINGER. That is right. We would have tails at 0.275, 0.30. At any time we have surplus capacity, we can strip further than indicated. This chart indicates the split tails concept.

(Chart referred to follows:)

SPLIT TAILS CONCEPT

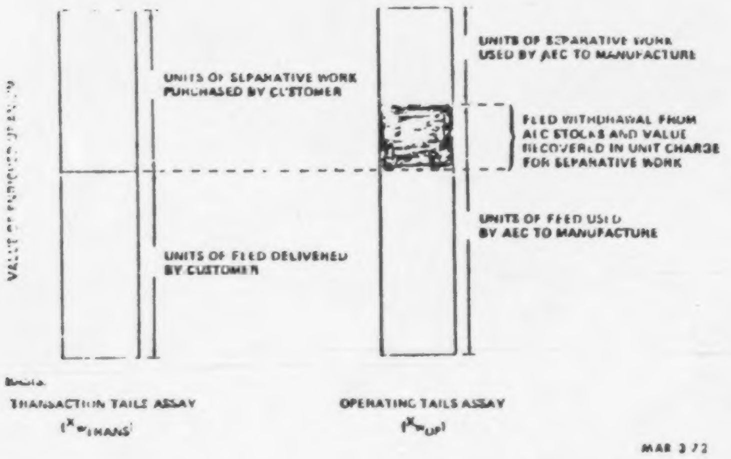
UNITS OF SEPARATIVE WORK PURCHASED BY CUSTOMER
UNITS OF FEED DELIVERED BY CUSTOMER
UNITS OF SEPARATIVE WORK USED BY AEC TO MANUFACTURE
FEED WITHDRAWAL FROM AEC STOCKS AND VALUE RECOVERED IN UNIT CHARGE FOR SEPARATIVE WORK
UNITS OF FEED USED BY AEC TO MANUFACTURE
Basis:
TRANSACTION TAILS ASSAY
($X_{w TRANS}$)
OPERATING TAILS ASSAY
($X_{w OP}$)
MAR 3 72

FIGURE 5

Dr. SCHLESINGER. With split tails, the utility customer provides less uranium than would be necessary to produce the amount of enriched material at the operating tails assay, and that shaded area indicates the amount of disposal from the AEC stockpile. What we are doing is trading a resource that is in relative surplus, feed material—for something that is in short supply, relatively speaking—to wit, enrichment capacity and electric power.

By so doing, we put greater value on our surplus stocks, postpone a decision and provide enriched material through this substitution process.

Representative HOSMER. The law, of course, specifies that your charge for a unit of separative work shall be based on cost of recovery.

Dr. SCHLESINGER. Yes, sir.

Representative HOSMER. This is not an accounting scheme which substitutes a certain amount of material for certain amounts of power. It costs the fellow who gets the work done the same, but in kind instead of in cash. Is that what makes it legal?

Dr. SCHLESINGER. It comes out that the $32 charge will be continued. The difference in cost of enriched uranium is only about one percent because the cost curve for operating between 0.20 and 0.30 tails assay is exceedingly flat.

Representative HOSMER. Part of your cost is a bookkeeping transfer from the stockpile?

Dr. SCHLESINGER. Right.

Representative HOSMER. To wherever it goes?

Dr. **Schlesinger.** What are we doing is selling more separative work units than we are actually producing. We substitute for that difference by running down our feedstocks.

TRANSFER OF DIFFUSION PLANT POWER

Representative **Hosmer.** Dr. Schlesinger we have been reading of possible power shortages this summer and thereafter. The one that happened last year did not happen because the AEC was releasing a lot of TVA power that was committed to it. Is that not correct?

Dr. **Schlesinger.** We have released power where we could alleviate a shortage.

Representative **Hosmer.** In case the crunch comes again in the future, would it be the AEC's intention again to release power?

Dr. **Schlesinger.** Well, we hope that contingency does not arrive. We would consult with the balance of the Government, and if in the view of the administration that is needed we should do so.

Representative **Hosmer.** Inasmuch as, Dr Schlesinger, such a release in power ends up in reduction in preproduction and as a consequence a potential reduction in revenues, would it be the intention of the AEC, if it does release kilowatts, that they be released at a cost that will compensate the Government for what it loses in the productive process?

Dr. **Schlesinger.** Yes, sir.

Representative **Hosmer.** That was not done in the past, was it?

Dr. **Schlesinger.** We had full cost recovery for the electric power that was released.

Representative **Hosmer.** Based on the price that you would have paid for it?

Dr. **Schlesinger.** Yes, sir.

Representative **Hosmer.** But not based on the total amount of funds you would have received by the eventual sale of preproduced material, as I understand it.

Mr. **Quinn.** Mr. Hosmer, the first power that was released, in the summer of 1970, was released on the basis of the cost of that electric power to AEC.

Representative **Hosmer.** Right.

Mr. **Quinn.** When it became apparent that this type of situation might be repeated in the future, we adopted a policy under which the price at which the power would be released would be such that the customers for enrichment services would suffer no penalty as a result.

Representative **Hosmer.** In other words, its value—

Mr. **Quinn.** We would get a return for that power somewhat more than the actual cost of the power to us, in order that the continuous fixed costs would not cause a higher unit charge to the enrichment customers.

Representative **Hosmer.** I certainly hope that you maintain firm in that policy.

REVIEW OF TOLL ENRICHMENT CONTRACTS

One other question. You state that the enriching services contracts are being reviewed with the objective of reducing certain of the uncertainties in future demand, which, of course, does not mean anything unless you say what uncertainties you are taking into consideration.

Dr. SCHLESINGER. We are reviewing those contracts with the possibility in [illegible] kind of having an iron-clad contract with the purchasing utility, [illegible] that we are able better to estimate future demand on the cr[illegible] going to a longer period of commitment by the utility.

Representative HOSMER. What does this mean: A take and/or pay for [illegible] of contract?

Dr. SCHLESINGER. Something along those lines.

CENTRIFUGE

Representative HOSMER. Along with your extrapolations with respect to the date for need for new capacity and so forth, I call to your attention for the first time in years in an AEC open document the use of the word "centrifuge," and you want some money to do some centrifuge work down at Oak Ridge to test our the economics of the centrifuge process.

Dr. SCHLESINGER. Yes, sir.

Representative HOSMER. Now, if the process tests out to be economic, that will relieve us of the necessity of worrying about another future diffusion plant, I guess.

Dr. SCHLESINGER. It could do so, Mr. Hosmer. At this point in time, the technical uncertainties and the cost uncertainties are sufficient so that a prudent decision would be to stay with gaseous diffusion. But we have 3 or 4 years before we would have to make a commitment to additional capacity. In that 3 or 4 years, these uncertainties

Representative HOSMER. You are working on that 1976 figure for industry starting up that new diffusion plant, or expanding your own?

Dr. SCHLESINGER. There would have to be at least an additional year's time for industry.

What the requirements in time might be for a centrifuge plant are not precisely clear at this point in time, because we have not yet built a sufficiently large test facility.

Representative HOSMER. We assume because of the nature of the beast that it would be considerably shorter than a diffusion plant, would it not?

Dr. SCHLESINGER. Yes, sir; we think it would be shorter, and you could build it in more of a piecemeal way.

Representative HOSMER. Thank you, Mr. Chairman.

Representative PRICE. Mr. Aspinall.

CONSTRUCTION OF ENRICHING FACILITIES BY OTHERS

Representative ASPINALL. Mr. Chairman; I have two or three general questions.

Do you have any commitment by foreign governments that they will construct enrichment facilities?

Dr. SCHLESINGER. No, sir.

Representative ASPINALL. Do you have any commitment or potential commitment that reputable firms in the United States will construct additional enrichment facilities at this time?

Dr. SCHLESINGER. Potential commitment is a broad expression. We have a number of expressions of strong interest, which might materialize in commitments.

Representative ASPINALL. If this is so, would any of them require legislation sponsored by this committee or some other committee of

Congress in order to effectuate your understanding of what they are willing to do at the present time?

Dr. SCHLESINGER. I think I will turn to our lawyers on that one, Mr. Aspinall.

Mr MISSEN. Mr Aspinall, I don't think that any domestic arrangements would require any additional legislation.

On a foreign arrangement, it would depend somewhat on the nature of it. We are holding in reserve according to how the arrangement might shape up.

I would like to reserve until some proposed arrangements might materialize and say for now that further legislation might be required.

Representative ASPINALL. I know you don't want to go too far in this, so don't go too far, but I would like to know at the appropriate time. Would it be the policy of the Commission to continue working toward the securing of such commitments?

Dr. SCHLESINGER. I think that that may be a little bit on the strong side.

What we want to do is to provide an open opportunity for private enterprise to come in. We encourage private enterprise to take up some of the burden.

Soliciting commitments, securing commitments, may be a little bit stronger than the phrase that I would be inclined to use at this stage of the game.

Representative ASPINALL. In other words, you want to limit your promotional activity?

Dr SCHLESINGER. Yes, sir.

Representative ASPINALL. Do I understand that it is your position that the leadtime suggested by you is sufficient to protect our needs, industrial and national?

Dr. SCHLESINGER. Yes, sir.

Representative ASPINALL. Have you taken into consideration the occasion of fire or serious accident in making your projections here to the committee?

Dr SCHLESINGER. The effect of such a serious accident in one of the plants would be to move backward in time the date at which additional capacity would be required, let us say 6 months or a year. So that it might be required in mid-1981 instead of the beginning of 1982.

The opportunity still exists in the next 3 or 4 years to adjust plans for expansion accordingly. Beyond that point in time, there is, as I mentioned, the possibility of reclaiming from the Department of Defense a large amount of oralloy in a number of weapons, and there is the possibility mentioned by Representative Hosmer of running the cascades at a level somewhat in excess of 0.30, if that should be required. We are not planning on that. But it does provide us with a hedge, with insurance against an accident of the sort you mentioned.

SELECTION OF SPLIT-TAILS MODE OF OPERATION

Representative ASPINALL. You speak of possibly reducing the operating tails assay from the current 0.30 percent to 0.275 after fiscal year 1973. I don't believe you have given us a criteria of what sort of choice you have in this. Do you have that at the present time? Could you furnish it to us?

Dr. **Schlesinger**. Yes, sir; we can furnish it for the record.

Representative **Aspinall**. Mr. Chairman, I would ask that it be made part of the record.

Representative **Hosmer**. Reserving the right to object, I did not understand the question.

Representative **Aspinall**. I would like to have the criteria by which they are making their projections as far as the reduction of the tails assay.

Representative **Hosmer**. Why they come to the 0.275?

Representative **Aspinall**. Yes. It is a matter of economics, as I understand.

Is that not right?

Dr. **Schlesinger**. Yes, sir; we will furnish the statement

(The additional statement subsequently supplied follows:)

The projected minimum operating tails assay of 0.275% U 235 and the potential operating range from 0.275% to 0.30% were selected on the basis of a number of considerations:

1. An operating tails assay in excess of 0.25% provides a desired deferral of the projected date for new capacity, as discussed in the testimony. However, increases beyond 0.30% do not result in significant additional deferrals and do involve substantial additional costs.

2. Using the current transaction tails assay of 0.20%, an operating tails assay of at least 0.275% is required to dispose of the 50,000 tons of excess AEC stocks in a reasonable time period. (The Plan described is projected to result in disposition of 50,000 tons by the end of FY 1982). On the other hand, substantially higher rates of disposal by means of operating at substantially higher tails assays would be constrained by the availability of AEC owned feed stocks for preproduction use.

3. The difference between the transaction and operating tails assays should be such as to permit the operation of the system, from the economic standpoint, with recovery of the market price value for feed supplied by AEC (including conversion costs associated with feeding this material to the enrichment plants) and recovery of appropriate enriching costs over a reasonable campaign period. This method of disposal should not, in itself, require an increase in the current $32 charge for separative work.

EFFECTS ON RAW MATERIALS INDUSTRY

Representative **Aspinall**. In your view, will the U.S. mining and milling industry be able to expand its capacity to meet the objective of feed material in 1980?

Dr. **Schlesinger**. As I think I mentioned in my statement, a major contribution that we can make to such an expansion is to provide the industry with a firm basis for planning. If they have that firm basis, we are persuaded that they will be able to respond

Representative **Aspinall**. If they have the firm basis you talk about, will they have the economic possibility of doing the job?

Dr. **Schlesinger**. Yes, sir.

IMPORT OF FOREIGN URANIUM

Representative **Hosmer**. Would the gentleman yield?

Representative **Aspinall**. Yes; I will be glad to.

Representative **Hosmer**. What bothers me is that you state by 1978 we will probably be permitting the import of foreign ores for domestic enrichment, and that in a couple of years you are going to come out with some kind of policy statement about it.

That, to me, without saying any more, leaves an uneasy feeling so far as what these raw materials people can expect

I don't want to anticipate your 2 years from now policy statement, but I think something ought to be said about that

Dr. SCHLESINGER. The method of split tails provides us with an implicit mechanism for disposing of the stockpile.

Representative HOSMER. We are going to get rid of the stockpile.

Dr. SCHLESINGER. The point that should be made is that the schedule of deliveries by the domestic uranium industry under the plan that we have presented to you today will be in excess of the deliveries that would have been in effect under the October 13 proposal that was discussed previously with Mr. Aspinall's subcommittee. There will be a better basis for the industry, particularly after 1975, for expansion of capacity.

On this basis, we expect that they will be able to be prepared for the onslaught of demand that comes after 1977.

Representative HOSMER. What I am getting at, can they expect an onslaught of foreign ore?

Dr. SCHLESINGER. The relaxation of the restriction would be adjusted so as to take an unbearable load off American suppliers, but would still permit the growth of American industry in that time frame. If there are American uranium reserves to be exploited, the intention would be that those reserves would be exploited.

Representative HOSMER. In other words, whatever this thing comes up to be, it will be on the basis of maintaining a viable and expanding raw materials industry in the United States?

Dr. SCHLESINGER. Yes, sir.

Representative HOSMER. There is no question about that?

Dr. SCHLESINGER. No, sir.

Representative HOSMER. Thank you.

URANIUM MILL TAILINGS

Representative ASPINALL. I am very pleased to hear that, too, Mr. Chairman.

On February 1, 1972, Mr. Chairman, a letter was sent to your office, personally signed by Chairman Pastore and Vice Chairman Melvin Price, inquiring about the possiblility of some aid in removing some of the uranium tailings at Grand Junction.

On February 11, 1972, a letter was sent to you by Executive Director Bauser, enclosing two bills, one introduced by my colleague, Senator Dominick, S. 3150, and one introduced by me, H.R. 13068. (See appendix 2, p. 2522.)

Those bills were in response to some mutual considerations that were given by the staff members of the committee and by members of the AEC.

To date, we have not received any comments from the Atomic Energy Commission as to the contents of the bills. As we are considering the authorization bill for this fiscal year, I think it is necessary that we have something in mind before we mark up the bill, as to the position of the Commission on this legislation, and as to whether or not the Commission will be favorable, perhaps the Commission would accept, if Congress authorized it, some liability in removing or in containing the radiation from the mill tailings used in construction

The Governor of Colorado has already stated his eagerness. He stated it with tongue in cheek because the way the bill was publicized, Colorado has to furnish one-fourth of the funds, but he has said that that he would accept it.

Now, are we going to be in a position to get some kind of comment from the Commission?

Dr. Schlesinger. Mr. Chairman, let me give you some comment right now.

Representative Aspinall. Wonderful.

Dr. Schlesinger. First, the Atomic Energy Commission is exceedingly favorable to the purposes of your bill. We favor providing authority to make the financial commitments which you have mentioned.

The reason for the delay in response to your letter is that there are certain points about the language which are of concern but which in no way alter the broad purposes for which the legislation was submitted. We are reviewing that language in order to determine whether any change in language is in order to perfect the purposes which you have specified would be desirable.

Representative Aspinall. Do you see any difficulty with the Office of Management and Budget?

Dr. Schlesinger. No, sir.

Representative Aspinall. Thank you very much.

Representative Price. Senator Dominick.

Senator Dominick. Thank you, Mr. Chairman.

Mr. Chairman, as you can well imagine, your statements that were made in answer to questions by Congressman Aspinall are just as much music to my ears as I am sure they are to his.

I might say for the record that I understand bills have been introduced in the Colorado Legislature already in order to try to get their share of money available in the event this bill should pass. So we are making steps in the right direction.

EFFECTS ON RAW MATERIALS INDUSTRY

Going back to some of the questions that Chairman Aspinall asked earlier, I want to get exactly what is going to happen to the raw materials industry clear in my mind, because some time ago I wrote you a letter in connection with foreign imports and disposal of surplus that was fairly biting.

It is my understanding that your proposal as you have it here is different from what it was before.

Dr. Schlesinger. I would say the letter was vigorous. I noticed no bite in it.

Senator Dominick. Specifically, my questions are this: Time and again we in Congress, with either the urging or the approval of the executive department, have put in incentive programs designed to serve a national interest. We did that in the uranium situation.

By virtue of having done that, and having American industry react as strongly as it did, we built up a surplus. As we always do whenever we build up a surplus that way, we then find it hanging over the market, and then we find that the whole law of supply and demand has been shot.

Obviously, if, having done this over a period of time, we should now dump this surplus in any way, either by enrichment process or by putting it in the yellow cake form available for sale, we could again do that same thing.

Equally obviously, if we allow a lot of foreign imports to come in at a time when the industry's market may be assured in the 1980's but it is not assured how it is going to get to the 1980's we could also find ourselves in trouble.

So would you just outline for me in real simple language that a layman like myself can understand, what the timetable is for disposal of the surplus, what the restrictions will be on foreign imports, and third, what the role of private industry will be during that period.

Dr. SCHLESINGER. On this chart, this curve indicates the expected smooth utilization of the Government's stockpile as a substitute for immediately expanded capacity and a substitute for electric power. In this way we are utilizing the stockpile so that we do not have the impact on the domestic market.

(Chart referred to, figure 6, follows:)

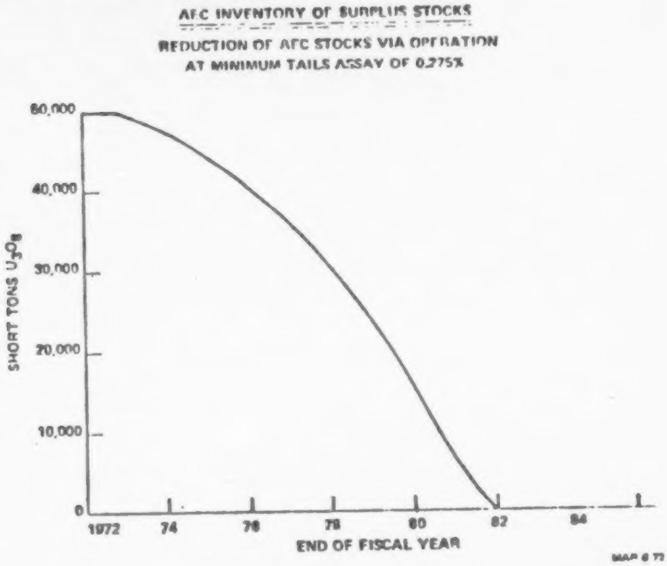

FIGURE 6

Dr. SCHLESINGER. The chief advantages of the proposal which we have laid before the committee from the standpoint of the uranium mining industry are, first; that there are no bids tabled, there will not be competition between the Government and the industry. The industry has been fearful that that would disrupt the market. Second, that we will have split tails, a suggestion that has come from the uranium mining industry, as a way of disposing of the stockpile while avoiding this upsetting of the market. Third; about one-third of this product will go to foreign purchasers; and, as a result, there will be that kind of supplement in our balance of payments and the use of the stockpile will be generalized outside of the United States.

Senator **Dominick**. So that the stockpile, according to your estimated curve, will be substantially depleted by 1982?

Dr. **Schlesinger**. Yes, sir.

Senator **Dominick**. The only remaining portion, then, would be whatever you wanted to use o' the depleted tails?

Dr. **Schlesinger**. Yes, sir. There is the contingency reserve.

Senator **Dominick**. I understand that.

Now, over and beyond that, what is happening insofar as foreign imports are concerned, so that we can put it all at one place in the record?

Dr. **Schlesinger**. As was indicated earlier in the questioning, a purpose of the administration, of the Government, is to maintain a viable domestic uranium mining industry. The relaxation of the restriction will be deferred until such time as the domestic industry has recovered from the recent shrinkage of demand and is operating more or less at capacity. The inflow of foreign uranium will be adjusted in those early years at the end of the decade to assure that the U.S. mining industry will continue to expand in order better to deal with the expected demands for uranium in the 1980's

Senator **Dominick**. One more question, Mr Chairman

During the process between the present time and the 1982 date that we are talking about, what is your estimate of the demand for the domestic industry?

Dr. **Schlesinger**. These represent the deliveries by the industry. As you can see by this chart, after calendar year 1976 the growth is very rapid.

(Chart mentioned, figure 7, follows:)

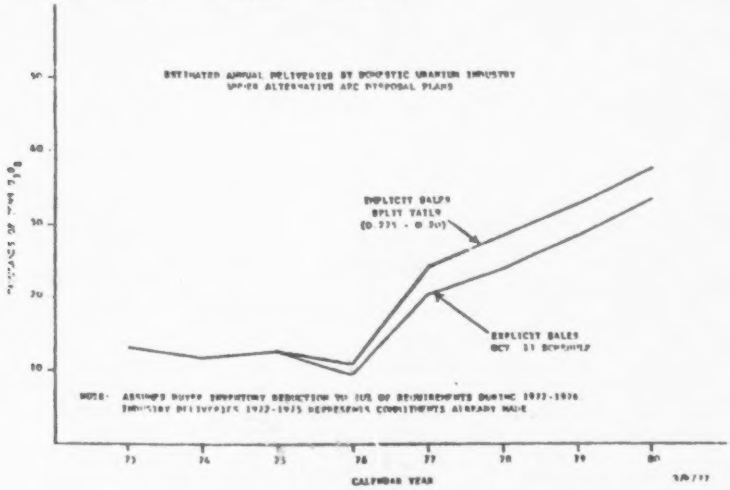

Figure 7

Dr. **Schlesinger** Capacity operation for the industry at the present time is about 16,000 tons. They are operating somewhat below that level at the present time. They are operating at less than capacity

EXHIBIT E

REVIEW OF FY 1975 OPERATIONS

E. R. Sullivan, Jr., Chief
Power Branch
Uranium Enrichment Operations Division
U.S. Energy Research and Development Administration
Oak Ridge, Tennessee

November 1975

We know that you in the electric utility industry are vitally concerned with ERDA's ability to enrich uranium; therefore, I would like to speak about some of the problems we have faced and the actions we have taken in securing electric power for the three gaseous diffusion plants. In my discussion, I will concentrate on the diffusion plant operations during the fiscal year 1975 which ended June 30, 1975.

It should be noted that FY 1975 began with the operating unions on strike at two of the diffusion plants. The third plant is now faced with an operating union strike that began about four weeks ago. During these strikes, the supervisory personnel have operated the cascades. While the strikes may have an effect on performing scheduled maintenance and a possible delay of the efforts of the Cascade Improvement and Uprating Programs (CIP and CUP), they have not had a significant effect on production.

Fiscal year 1975 was the most difficult period we have experienced in being able to purchase the amount of power that was desired, to predict the quantity to be delivered and to estimate its cost. As you are well aware, sharp increases in the cost of coal occurred and, at the same time, the availability of coal fell which had the result of increasing the cost of power to us and reducing the power available. The power suppliers serving the diffusion plants were beset with other unprecedented problems that prevented them from delivering the amount of power that ERDA planned on being available during the year. Such problems as: (1) Slippages in TVA's generating plant construction program, (2) Reduced TVA deliveries to ERDA due to ERDA reducing its contract demand, at TVA's request, to alleviate shortages of electric power to its residential and commercial consumers, (3) TVA's reduced TVA deliveries above ERDA's contract demand because the Browns Ferry fire reduced its generating capability, and (4) A slight reduction in the OVEC deliveries while recovering from a tornado that wiped out the Clifty Creek Generating Station switchyard at Madison, Indiana. The effects of all of these factors on ERDA were (1) a reduction in the amount of power that ERDA planned to purchase with an attendant reduction in the separative work produced during the year, and (2) an increase in the unit cost of power that was so great that it was necessary to increase the total cascade power budget by $5 MM even though the 31 billion kilowatt hours purchased were about 20 percent lower than we had provided for in the budget.

We have had excellent cooperation from all three of our power suppliers. OVEC was strongly supported by its Sponsoring Companies in rebuilding the Clifty Creek switchyard after the tornado and in furnishing supplemental power to OVEC for delivery to ERDA during the period that the station was unable to generate. This helped to minimize our production shortfall since more than 50 percent of our share of OVEC capacity was represented by the Clifty Creek station.

TVA has permitted us to shift power between Oak Ridge and Paducah in conjunction with the 500 MW seasonal deliveries from EEI, thereby permitting us to optimize those two plants for maximum production.

I would now like to show you some of the fiscal year 1975 data.

Table 1 - FY 1975 Production. Cascade power received was 3546 MW which was about 20 percent lower than the power we had included in our budget. Notice also that there was about a 27 percent increase in the unit cost of the power. Production was down by about 18 percent and the unit cost of production, due to power only, was up by 24 percent. The production shortfall was not entirely reflected in the preproduction stockpile since the actual requirements for enriching services were somewhat lower than planned as indicated in the last column.

Table 2 - FY 1975 Feed. Reduced power purchased had a corresponding effect on the need for feed, reducing the total to the cascade by 4500 MTU or about 16 percent. At the same time, there was a 4,000 MTU reduction in the feed that we actually received from the toll enriching customers.

Table 3 - Coal Cost - FY 1975. As we indicated earlier, the principal reason for the increased unit cost of power was due to the dramatic increase and the cost of coal to the utilities. The actual cost of coal to the three suppliers ranged from 35 to 45 percent greater than was anticipated when the President's budget was submitted to Congress.

FY 1976

Lets now take a brief look at fiscal year 1976 as to our budgeted plans and what the picture appears to be at this time. The President's budget was submitted to Congress, based on our being able to purchase about 4700 MW, and the amended budget calls for cascade power at $532 million. An amendment to the cascade power budget was necessary after the President submitted his budget to Congress in January to cover the increased costs of power due to

FY 1975 budget.

In our FY-76 plans, we anticipated being able to increase our take from TVA by 625 MW beginning September 1, 1975, however, at this time, it appears certain that this increase cannot be made before January, 1976 because of TVA's difficulties in getting its Browns Ferry-3 unit in commercial operation. The effect of delaying the 625 MW increase until January would be a reduction of about 570 MTSWU.

In an effort to recover some of this shortfall, we are seeking authority to be able to purchase "additional power" for short periods of time, three days, one week, etc., as it may become available. We have no way of predicing how much power we might buy in this category, but we expect it to be limited in its availability and, of course, we cannot be unreasonable in what we pay for this power.

In evaluating the feed availability and usage, we must consider operations over the next several years and, as a result of these evaluations, we reduced the operating Xw from 0.30 percent to 0.25 percent at the beginning of FY-76. This change reduces the feed requirements from about 28,500 MTU to approximately 22,700 MTU (21,200 + tails recycle) and also allows us to recycle the 0.30 tails from stockpile which provides a portion of the total feed required. By refeeding approximately 13,400 MTU of 0.30 percent tails which is our present capability, we in effect recover approximately 1450 MTU normal feed from the tails stockpile. Additional details regarding tails recycle will be presented in Joe Parks' discussion of "Alternate ERDA Operating Plans."

The Long-Term Picture

As many of you know, we started increasing the power levels of the plants in 1970 from a three-plant total of 2,000 MW and are planning for a fully uprated (CUP) level of 7380 MW. All of the 7380 MW is under contract except for about 270 MW which is to be included in the contract we are now negotiating with OVEC for delivery to the Portsmouth plant. We anticipate that this block will be under contract in the very near future.

Our contracts with TVA provide for the firm delivery of additional increments of power as follows:

395 MW (Restoration) - October 24, 1983
435 MW (CUP) - May 14, 1984
490 MW (CUP) - July 30, 1984

The contracts also provide for TVA to begin delivering these blocks at various dates between April, 1978 and April, 1980 on a firm basis if TVA has sufficient generating capacity. From time-to-time, prior to the firm delivery dates, TVA may also be able to provide additional power. Mr. Parks will talk more about these blocks of power and the production impact.

TABLE 1

FY 1975 PRODUCTION

	CASCADE POWER		PRODUCTION		TE REQUIREMENTS
	(MW)	($/MWH)	(MTSWU)	($/SWU)*	(MTSWU)
PLANNED	4421	8.0	14,200	21.73	10,000
ACTUAL	3546	10.1	11,605	27.02	8,365

*DUE TO POWER COST ONLY.

TABLE 2

FY 1975 FEED

	TOTAL TO CASCADE (MTU)	FROM TE CUSTOMERS (MTU)
PLANNED	27,500	16,500
ACTUAL	23,000	12,500

TABLE 3

COAL COST - FY 1975

(¢ PER MILLION BTU)

	TVA	EEI	OVEC
PLANNED	46	56	47
ACTUAL	62	82	66
JULY, 1974	45	57	59
JUNE, 1975	85	89	67

EXHIBIT F

URANIUM ENRICHMENT POLICIES

William R. Voigt, Jr., Director
Division of Uranium Resources & Enrichment
Department of Energy
Washington, DC

October 1978

INTRODUCTION

Over the past year, DOE has taken a number of significant actions aimed at re-entering the market as a supplier of enrichment services. The DOE (and its predecessors, the Atomic Energy Commission and the Energy Research and Development Administration) has always been a reliable supplier of enrichment services. For example, of the over 4,000 deliveries to date from the DOE enrichment plants which were destined for nuclear power reactors throughout the world, conditions at the enrichment plants resulted in only two delays in deliveries. These delays were each for less than three weeks for reassay of the enriched uranium.

OPENING THE ORDER BOOK

On May 26, 1978, Secretary Schlesinger announced that the DOE was ready to accept new orders for enrichment services with domestic and non-U.S. customers. This announcement followed Congressional Hearings that revised the criteria under which enrichment services are offered. The revision recognized that the enrichment capacity of the DOE was being expanded by the construction of the 8.8 million SWU per year Gas Centrifuge Enrichment Plant at Portsmouth, Ohio.

In July 1974, the U.S. stopped contracting for enrichment services because the expected capacity of the three Gaseous Diffusion Plants had been reached. However, with new centrifuge capacity coming on line in the late 1980's, the DOE has resumed contracting for enrichment services. Furthermore, by re-entering the enrichment services market the U.S. has enhanced its ability to provide fuel assurance to those nations abiding by appropriate non-proliferation obligations.

TERMS OF THE ADJUSTABLE FIXED-COMMITMENT CONTRACT

The vehicle being used in resuming contracting is a new contract form--the Adjustable Fixed-Commitment (AFC) contract. This new contract, which replaces the current Long-Term Fixed-Commitment (LTFC) contract, provides both domestic and non-U.S. customers more attractive terms and conditions for purchasing U.S. enrichment services; thus, the contract is responsive to the changing needs of enrichment services customers. I believe this contract is highly competitive with the enrichment services arrangements offered by other current suppliers of enrichment services. Compared with the LTFC contract, the AFC contract offers the following advantages to enrichment services customers, as shown on Chart 1:

- Flexibility in delivery quantities
- The ability to reschedule deliveries
- Reduced leadtime requirements
- A reasonably short firm delivery schedule period
- An upper limit of 0.25% U-235 on the transaction tails assay
- A limit on the price that can be charged for enrichment services
- The possibility to use a variable tails assay option; this option was discussed at last year's Uranium Enrichment Seminar.

It is also expected that most of the current LTFC contracts will be converted to the new AFC contract. Since the customers will have considerably more latitude in the amount of enrichment services they must take, they will have a corresponding latitude in the amount of natural uranium they must deliver to DOE for enrichment. Thus, the AFC contract will result in an added degree of uncertainty for the natural uranium supply industry. On the other hand, the flexibility contained in the AFC contract will allow the demand for natural uranium to be kept more in tune with reactor requirements. Thus, the natural uranium supplier will not be subjected to sudden changes in schedule as was true with the LTFC contract. Consequently, temporarily artificial requirements resulting from such things as advanced feed deliveries should no longer be necessary.

In this regard, when a customer with an LTFC contract containing an advance feed schedule converts his contract to an AFC contract, the requirement to make subsequent natural uranium deliveries as specified in the schedule will be dropped. All natural uranium received previously by DOE under the terms of the LTFC contract and not yet applied to enrichment services already delivered will be converted to a "Usage Agreement". The "Usage Agreement" is a DOE-provided contract that allows the enrichment services customer to provide natural uranium to the DOE earlier than enrichment services would dictate. In addition, those customers having contracts with uranium suppliers which require them to take delivery of natural uranium intended to meet the LTFC contract schedules may request DOE to accept that natural uranium under "Usage Agreements". This should alleviate any buildup of natural uranium which otherwise would have been in the hands of enrichment services customers.

DOE PROJECTION OF NUCLEAR POWER GROWTH

In March of this year, DOE prepared a projection of the growth of nuclear power which has since been used in planning the long-range operation of the DOE enrichment plants. This projection was based on examining the status of existing construction, on a reactor-by-reactor basis, for each reactor in the U.S. Then by using past experience on the amount of time required to complete the construction and bring the reactor on-line, the growth of nuclear power in the U.S. was determined.

The estimates for domestic nuclear power on-line in 1985 were limited to the completion of Light Water Reactors with a significant amount of construction completed to date. The estimate of non-U.S. reactors was developed analogously, but only for those reactors which held DOE enrichment services contracts, or were expected to have DOE enrichment services contracts. As seen on Chart 2, these estimates of nuclear power plant capacity resulted in 115 gigawatts of domestic nuclear power in 1985, and 65 gigawatts of non-U.S. nuclear power supported by DOE enrichment capacity would be on line in 1990.

The estimates for 1990 included planned reactors not currently under construction, but which DOE judged would be needed and available to meet forecast electric power requirements. The non-U.S. projection for 1990 was based on the same considerations, but included only reactors expected to have DOE enrichment services contracts. The non-U.S. planning projection is less certain than the domestic estimate because of the comparatively lower quality of information about non-U.S. reactor construction plans, and also because the impact of the AFC contract terms is less certain. The results of the projection indicated that 185 gigawatts of domestic nuclear power and 100 gigawatts of non-U.S. power

By July 1, 1978, the current holders of LTFC contracts provided DOE a non-binding notice of intent to convert to the AFC contract and some enrichment services schedule information. The result of this information would indicate a demand for enrichment services (and, thus, a need for natural uranium) greater than the DOE planning projections discussed above. Roger Gagne, who will be the next speaker, will discuss this in more detail. However, in the July 1 notifications, customers were not required to make firm commitments under the AFC contract. Customer demand is expected to erode further in the future as actual conversion from the LTFC contract to the AFC contract takes place.

STATUS OF DOE ENRICHMENT PLANTS

The DOE has three major construction programs to expand the capacity of its enrichment facilities as shown on Chart 3:

- The Cascade Improvement Program (CIP)
- The Cascade Uprating Program (CUP)
- The Gas Centrifuge Enrichment Plant (GCEP) being built at Portsmouth, Ohio

The CIP and CUP programs will increase the enrichment capacity of the Gaseous Diffusion Plants by almost 60 percent. The CIP incorporates the latest advances in gaseous diffusion technology into the existing process equipment. The CUP, which is being conducted concurrently with the CIP, uprates the equipment to allow the plants to use effectively more electrical power. Both programs are on schedule and will be completed in 1981.

The GCEP marks the first production size uranium enrichment plant other than diffusion ever built in the United States. It is significant that the GCEP will use only about 4 percent of the electrical energy of a similar-sized gaseous diffusion plant. This remarkable energy-saving achievement was made possible by over 20 years of basic centrifuge research, development and demonstration, culminating in a proven technology by the spring of 1977, such that the centrifuge process could be selected for use in the Portsmouth enrichment plant. Many different sizes of centrifuges were designed, fabricated and tested during these years, and some individual centrifuges have run continuously in a separation mode for about eight years. To demonstrate the operating efficiency and reliability of the centrifuge design selected for the Portsmouth GCEP, an Advanced Equipment Test Facility was started up in May 1978 at Oak Ridge, Tennessee. Another facility is now under construction at Oak Ridge to further demonstrate a complete centrifuge unit cascade which will be prototypical of a GCEP unit cascade in every possible significant detail. Scheduled for operation in the summer of 1982, this unit cascade in the Centrifuge Plant Demonstration Facility (CPDF) will serve as the first market for commercial manufacturers of centrifuges, service modules and other important equipment necessary for the GCEP.

The GCEP will ultimately provide about 8.8 million SWU per year of additional uranium enrichment capacity, or an increase of about 32 percent to the improved and uprated Gaseous Diffusion Plants. The GCEP, which is being built on a schedule designed to meet enrichment services demand, will permit the DOE to (1) assure existing and new uranium enrichment customers that their services will be provided at a tails assay not exceeding 0.25% U-235 and (2) sign new contracts for uranium enrichment services.

Based on the planning projection I discussed earlier, the DOE recently stretched the completion date for the GCEP. This schedule calls for having an annual capacity of 2.2 million SWU on-line by the end of 1988, with follow-on capacity added in annual increments of 1.1 million SWU at a rate to match future enrichment demand.

DOE INVENTORIES OF NATURAL AND ENRICHED URANIUM

As shown on Chart 4, on October 1, 1978, DOE had inventories of

- 6700 metric tons of enriched uranium at a nominal assay of 3.2% U-235
- 22,400 metric tons of DOE-owned and customer-owned natural uranium as UF_6, equivalent to 29,100 short tons of U_3O_8.

It is DOE's plan that the enriched uranium inventories will be used:

1. To meet requirements for enrichment services in those future years where the demand for separative work is greater than the supply of separative work, and

2. To provide a working inventory of enriched uranium, needed in order that DOE may provide enrichment services on a timely basis, and cover possible U.S. participation in bilateral, multilateral or international nuclear fuel arrangements.

In this regard, the recently announced advanced sale of enrichment services to Japan will not affect this plan. The Japanese will have merely prepaid for enrichment services that they will take in the future under their enrichment services contracts, using a portion of the separative work contained in the DOE enriched uranium inventory to backup the sale.

It is also intended that the DOE-owned portion of the natural uranium inventory, in conjunction with a small portion of DOE's enrichment capacity, be used to supply U.S. Government requirements for enriched uranium. In addition, this inventory will be used to maintain appropriate DOE enriched uranium inventory levels and could also be used in the event that unexpected short-term emergency needs for enriched uranium would occur.

TAILS ASSAY EXPECTATIONS

Chart 5 summarizes the DOE tails assay expectations. With the planning projection discussed above, our analysis of long-range enrichment plant operations indicates that the current 0.20% U-235 transaction tails assay can be maintained until at least the late 1980's. Eventually, with the contracts DOE expects to sign, the transaction tails assay may need to be increased to 0.25% U-235, but this is not expected to occur until after the late 1980's.

The projections also indicate that the DOE enrichment plants can be operated at a tails assay of 0.20% U-235 and still maintain reasonable enriched uranium inventory levels. Accordingly, on October 1, 1978, the operating tails assay was reduced from 0.25% U-235 to 0.20% U-235. Our current expectation is the 0.20% U-235 operating tails assay can also be maintained until the late 1980's.

CHART 1

ADJUSTABLE FIXED-COMMITMENT CONTRACT

- FLEXIBILITY IN DELIVERY QUANTITIES
- ABILITY TO RESCHEDULE DELIVERIES
- REDUCED LEADTIME REQUIREMENTS
- REASONABLY SHORT FIRM DELIVERY SCHEDULE PERIOD
- LIMIT OF 0.25% U-235 ON THE TRANSACTION TAILS ASSAY
- LIMIT ON THE PRICE THAT CAN BE CHARGED FOR ENRICHMENT SERVICES
- POSSIBILITY OF USING VARIABLE TAILS ASSAY OPTION

CHART 2

DOE PROJECTION OF NUCLEAR POWER

END OF CALENDAR YEAR	THOUSANDS OF MEGAWATTS		
	DOMESTIC	NON-U.S.	TOTAL
1985	115	65	180
1990	185	100	285

CHART 3

PROGRAMS TO EXPAND U.S. ENRICHMENT CAPACITY

- CIP & CUP
  - WILL BE COMPLETED WITHIN THE COST ESTIMATE OF $1.5 BILLION
  - WILL EXPAND GASEOUS DIFFUSION CAPACITY BY 60 PERCENT
  - IS ON SCHEDULE AND WILL BE COMPLETED IN 1981
- GCEP
  - WILL ADD 8.8 MILLION SWU PER YEAR
  - WILL ASSURE CUSTOMERS THAT THEIR TAILS ASSAY WILL NOT EXCEED 0.25% U-235
  - ALLOWS DOE TO SIGN NEW ENRICHMENT SERVICES CONTRACTS

CHART 4

DOE INVENTORIES OF ENRICHED & NATURAL URANIUM
AS OF OCTOBER 1, 1978

- 6700 METRIC TONS OF ENRICHED URANIUM AT A NOMINAL ASSAY OF 3.2% U-235
- 22400 METRIC TONS OF DOE-OWNED AND CUSTOMER-OWNED NATURAL URANIUM AS UF_6

CHART 5

TAILS ASSAY EXPECTATIONS

- TRANSACTION TAILS ASSAY
  - – 0.20% U-235 MAINTAINED UNTIL AT LEAST LATE 1980's
  - – NO GREATER THAN 0.25% U-235
- OPERATING TAILS ASSAY
  - – REDUCED TO 0.20% U-235 ON OCTOBER 1, 1978
  - – MAINTAINED AT 0.20% U-235 UNTIL LATE 1980's